VIDEOMASTER

KIT

HOME T.V. GAME

ASSEMBLY MANUAL

VIDEOMASTER VM.III KIT

Please note that on your unit the GAME SELECTOR SWITCH (S.2) is marked 1-2-3 for the three game functions which are as follows:

1. PING PONG
2. SOLO
3. CATCH BALL

Assembly Manual Errata:

Circuit Diagram - Page 31 :

T2 incorrectly marked as T4
T4 incorrectly marked at T2

Diode connected to G23 (N5) should be marked as D9 and not D7.

Circuit description Page 31 et seq:

Read T2 as T4 and vice-versa.
Read D9 in place of D7 on page 32 and 33.

003/5/01
September 1975.

VIDEOMASTER™

EUROPE'S LEADERS IN HOME TV GAMES

INTRODUCTION TO THE VM 3 KIT

The VIDEOMASTER HOME TV GAME KIT has been specially designed for you to build yourself utilizing some of the latest CMOS [Complementary Metal Oxide Semiconductor] I.C. circuitry.

All the parts, except the PP7 battery required, have been provided including enough solder to complete the unit. The printed circuit board is fully drilled, has a legend printed on the component side to identify all the component positions and also has a solder resist printed over the tracks to protect the board to make the soldering as easy as possible.

Once you have completed your VIDEOMASTER you will be able to play three or more exciting games on your domestic TV set (B & W or colour).

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UNPACKING

Before starting construction of your kit you should check the component packs supplied and make sure that you recognise and are familiar with every type supplied. The parts list and also the assembly instructions will show you, if you are not sure, what they look like.

WARNING

THE CMOS INTEGRATED CIRCUITS SHOULD BE LEFT IN THEIR PROTECTIVE CONTAINER UNTIL IMMEDIATELY REQUIRED FOR ASSEMBLY. These devices are susceptable to damage due to stray static electricity if handled carelessly. However, they are internally protected against static under normal circumstances, but it is wise not to take unnecessary risks.

The components for the VIDEOMASTER VM 3 are packed as follows:-

Pack 1	48 Resistors
Pack 2	31 Capacitors
Pack 3	11 Diodes & 4 Transistors
Pack 4	11 CMOS I.C.s
Pack 5	5 Potentiometers (Pots)
Pack 6	Plugs, sockets, switches, etc.
Pack 7	Assorted Hardware
Pack 8	Wire and cable

Loose packed

Plastic cabinet
Control boxs
R.F. Modulator (UHF or VHF as ordered)
Printed Circuit Board

All the components for the VIDEOMASTER VM3 Kit are itemised in the parts list against cross reference parts numbers to the printed legend on the component side of the P.C.B. (Printed Circuit Board), and also the circuit diagram. The part numbers (eg: R1 R2 R3 resistors, C1 C2 C3 capacitors, D1 D2 D3 diodes etc.) will enable you to identify the correct location of each electrical component in the assembly.

VIDEOMASTER VM3 KIT PARTS LIST

RESISTORS

Part No.	Value Ohms	Colour code bands 1st	2nd	3rd	4th
R1	33K	ORANGE	ORANGE	ORANGE	GOLD
R2	33K	ORANGE	ORANGE	ORANGE	GOLD
R3	47K	YELLOW	MAUVE	ORANGE	GOLD
R4	47K	YELLOW	MAUVE	ORANGE	GOLD
R5	22K	RED	RED	ORANGE	GOLD
R6	22K	RED	RED	ORANGE	GOLD
R7	150K	BROWN	GREEN	YELLOW	GOLD
R8	22K	RED	RED	ORANGE	GOLD
R9	150K	BROWN	GREEN	YELLOW	GOLD
R10	10K	BROWN	BLACK	ORANGE	GOLD
R11	47K	YELLOW	MAUVE	ORANGE	GOLD
R12	33K	ORANGE	ORANGE	ORANGE	GOLD
R13	330K	ORANGE	ORANGE	YELLOW	GOLD
R14	1.2M	BROWN	RED	GREEN	GOLD
R15	220K	RED	RED	YELLOW	GOLD
R16	10K	BROWN	BLACK	ORANGE	GOLD
R17	10K	BROWN	BLACK	ORANGE	GOLD
R18	10K	BROWN	BLACK	ORANGE	GOLD
R19	220K	RED	RED	YELLOW	GOLD
R20	47K	YELLOW	MAUVE	ORANGE	GOLD
R21	2.2M	RED	RED	GREEN	SILVER
R22	3.3K	ORANGE	ORANGE	RED	GOLD
R23	10M	BROWN	BLACK	BLUE	SILVER
R24	10M	BROWN	BLACK	BLUE	SILVER
R25	47K	YELLOW	MAUVE	ORANGE	GOLD
R26	10M	BROWN	BLACK	BLUE	SILVER
R27	10M	BROWN	BLACK	BLUE	SILVER
R28	10M	BROWN	BLACK	BLUE	SILVER
R29	47K	YELLOW	MAUVE	ORANGE	GOLD
R30	470K	YELLOW	MAUVE	YELLOW	GOLD
R31	470K	YELLOW	MAUVE	YELLOW	GOLD
R32	470K	YELLOW	MAUVE	YELLOW	GOLD
R33	470K	YELLOW	MAUVE	YELLOW	GOLD
R34	470	YELLOW	MAUVE	BROWN	GOLD
R35	470K	YELLOW	MAUVE	YELLOW	GOLD
R36	2.2K	RED	RED	RED	GOLD
R37	10K	BROWN	BLACK	ORANGE	GOLD
R38	3.3K	ORANGE	ORANGE	RED	GOLD
R39	10K	BROWN	BLACK	ORANGE	GOLD
R40	1K	BROWN	BLACK	RED	GOLD
R41	22K	RED	RED	ORANGE	GOLD
R42	390K	ORANGE	WHITE	YELLOW	GOLD
R43	2.2K	RED	RED	RED	GOLD
R44	10K	BROWN	BLACK	ORANGE	GOLD
R45	10M	BROWN	BLACK	BLUE	SILVER
R46	22K	RED	RED	ORANGE	GOLD
R47	22K	RED	RED	ORANGE	GOLD
R48	470K	YELLOW	MAUVE	YELLOW	GOLD

Note: Resistors listed with 4th band as silver (ie:tolerance=10%) may be supplied with GOLD 4th band (ie: tolerance=5%).

CAPACITORS

Ceramic type (Disc or rectangular plate)

Part	Value
C1	100pF
C2	330pF
C3	330pF
C4	330pF
C5	330pF
C6	100pF
C7	100pF
C8	100pF
C9	10nF (=10000pF)
C10	10nF
C11	10nF
C12	10nF
C13	10nF
C14	10nF
C15	10nF
C17	10nF
C18	330pF
C19	100pF
C20	330pF
C23	4.7nF (=4700pF)
C26	4.7nF

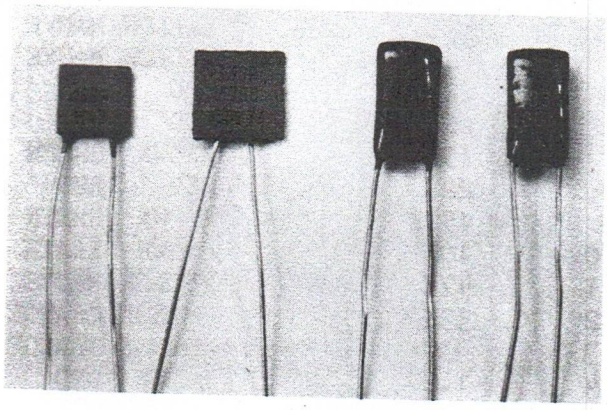


Fig.1

Polyester type

C21	100nF (= 0.1uF)
C24	100nF
C25	100nF
C27	100nF
C31	100nF

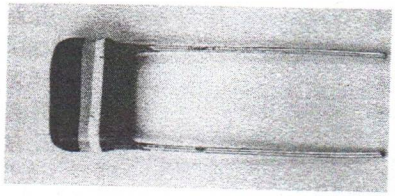


Fig.2

Electrolytic type

C16	22uF
C22	1uF
C28	1000uF
C29	220uF
C30	47uF

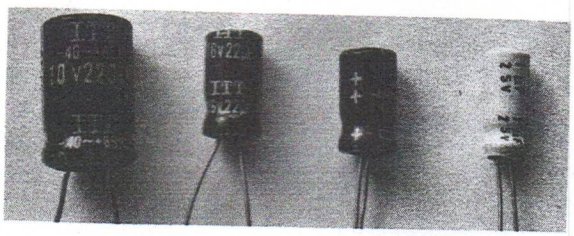


Fig.3

DIODES

All Diodes D1 to D11 are type 1N4148

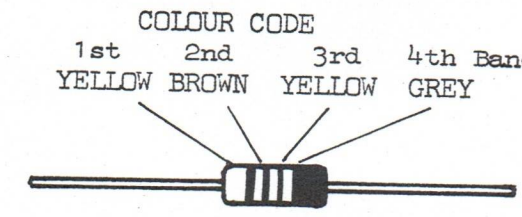


Fig.4

+ END (=CATHODE) (ANODE)

TRANSISTORS

All Silicon planar types in plastic or epoxy encapsulation.

Part No.	Type	Designation
T1	PNP	ZTX212 or BC212K or BC205K
T2	NPN	2N3663
T3	NPN	ZTX108 or BC182K or BC208K
T4	NPN	ZTX108 or BC182K or BC208K

PIN CONFIGURATIONS

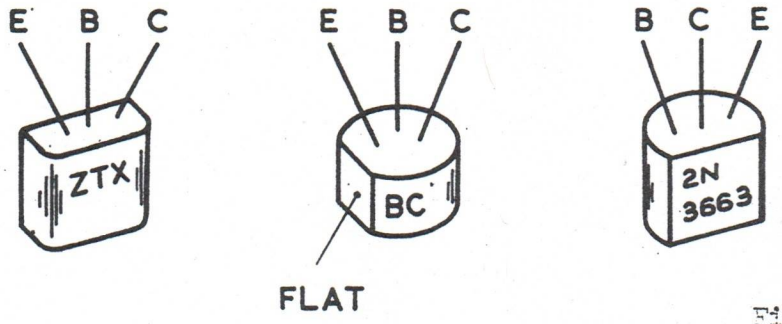


Fig.5

POTENTIOMETERS

Part No.	Value OHMS	Type
VR1	4.7K (Lin)	P.C. mounting
VR2	4.7K (Lin)	P.C. mounting
VR3	100K (R.Log)	P.C. mounting
VR4	22K (Lin)	Bush mounting
VR5	22K (Lin)	Bush mounting

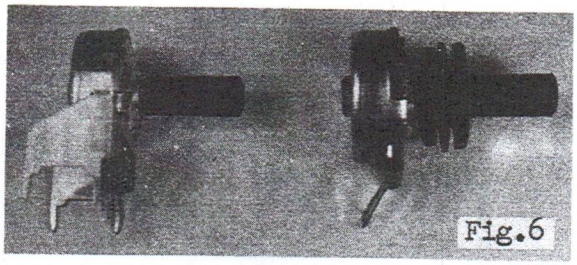


Fig.6

INTEGRATED CIRCUITS

All the ICs are National Semiconductors 74C series CMOS devices. CAUTION: handle only when absolutely necessary for assembly in order to prevent accidental damage by static electricity.

Part No.	Type code
N1	MM74C00N
N2	MM74C00N
N3	MM74C00N
N4	MM74C02N
N5	MM74C02N
N6	MM74C02N
N7	MM74C02N
N8	MM74C02N
N9	MM74C02N
N10	MM74C02N
N11	MM74C02N

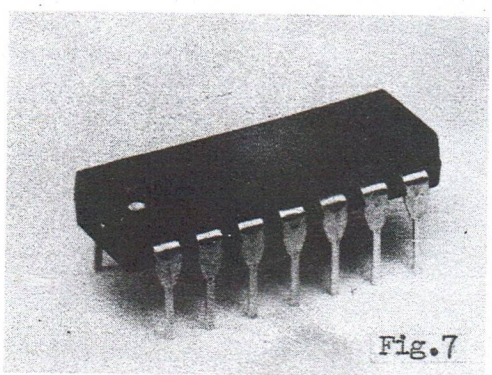


Fig.7

MISCELLANEOUS PARTS

Part No.	Item
S1	Single pole slide switch
S2	4 pole - 3 position slide switch
PB1	Single pole push button (push to make)
PB2	Single pole push button (push to make)
SKT1	Din 5 pin socket, P.C. mounting
SKT2	Din 5 pin socket, P.C. mounting
PL1	Din 5 pin plug
PL2	Din 5 pin plug
PCB	VM.3 D printed circuit board

- -

Assorted hardware

1 off	R.F. modulator unit with co-axial lead and plug attached
2 off	Control knobs for pots.
2 off	Plastic boxs for control units
1 off	Plastic cabinet for game board (2 parts)
2 off	Brass hinge pins for cabinet
2 off	Aluminium panels for control units
1 off	battery retainer bracket
2 off	battery connector clips for PP.7
8 off	Self tapping screws for control box panels
6 off	6 B.A. Bolts Cheese head
2 off	6 B.A. Bolts bright plated round head
8 off	6 B.A. Nuts
4 off	6 B.A. Washers
4 off	8 B.A. Bolts
4 off	8 B.A. Nuts
4 off	8 B.A. Washers
2 off	6 B.A. Tapped Pillars
4 off	Rubber feet
2 lengths	4 core cable
10 lengths	one of each colour, stranded wire: Black, brown, red, orange, yellow, green, blue, grey, white and pink.
1 length	Multicore Solder (60/40 Tin-Lead)
1 length	Large bore PVC plastic sleeving

NOTE: The 8B.A. sized nuts, bolts and washers are smaller than the 6B.A. ones.

ASSEMBLY METHOD

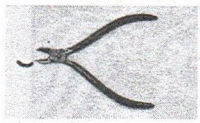
In order to ensure complete success in building your VIDEOMASTER VM 3 the component parts must be assembled in a methodical manner with proper attention to the step by step instructions.

The assembly instructions divide up the work into groupings of like components in a progressive sequence. Each step covers the assembly of a group of components (eg: Step 1 Resistors). As each numbered part is assembled, it should be ticked off the parts list, as each step is completed that too should be ticked off. By using the step by step instructions with the parts list hopefully you will not overlook anything or make any errors.

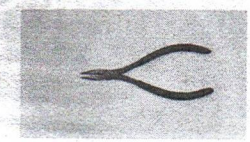
TOOLS

You will need the following tools to assemble your kit:-

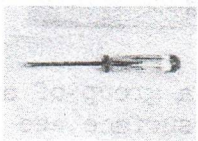
Side Cutters



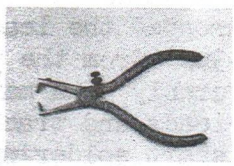
Long Nosed Pliers



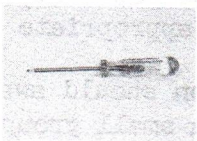
Small Screwdriver



Wire Strippers



Small Phillips Screwdriver



Light Electric Soldering Iron
10 - 30Watts (or temp. contolled)
with small bit less 1/8 inch at the tip.

A tape measure or ruler

VERY IMPORTANT

YOU MUST CHECK THAT YOUR SOLDERING IRON HAS A SATISFACTORY EARTH CONNECTION ELSE YOU MAY DAMAGE THE CMOS INTEGRATED CIRCUITS.
If you are in any way unsure about the earthing of your iron, or if you have not had much experience with assembling integrated circuits then obtain IC sockets and solder these in place instead of the IC's themselves. When you have completed the unit, the IC's can be safely plugged into the sockets.

A suplementary pack of 11 14pin IC sockets may be obtained from us, priced £ 1.60 inclusive of VAT etc. [Order code PACK 11S]

Other tools not essential, but very useful if you have them are:-

6B.A. and 8B.A. Tubular spanners or nut drivers, a Solder Sucker & Multimeter

NOTE: An electric bell or buzzer must never be used to make continuity checks due to the high voltages produced which would damage the semiconductors. A multimeter set on the lowest ohms range is however, ideal for this purpose if required.

SOLDERING HINTS

Poor soldering is the most frequent cause of kits not working first time, so it's important that you are using the right technique from the start.

When assembling the components on the board ensure each part fits with its body square on the board (except transistors - keep their leads long). When the part is pushed home, bend the leads outwards on the track side of the board at about 45° as in Fig.8. This will retain them in place prior to cropping the leads.

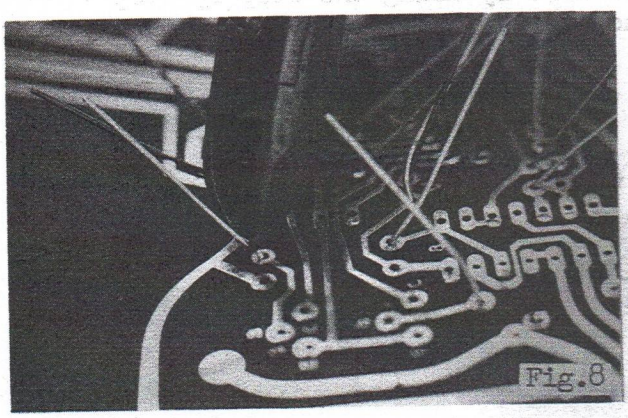


Fig.8

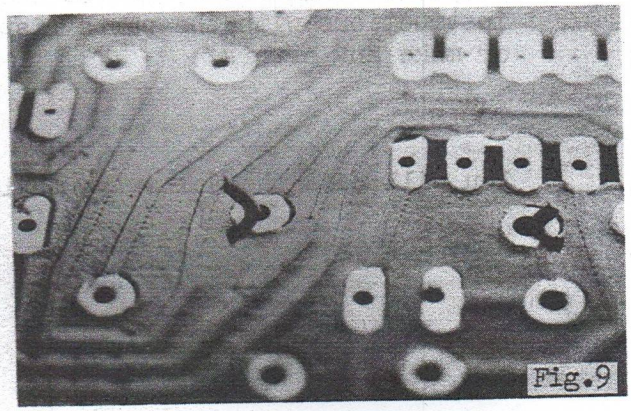


Fig.9

Having cropped the leads of a group of assembled components to about 1/10th inch (2-3mm) from the track surface (see Fig.9), place the board track side up, preferably on a mat of sponge foam or in an assembly stand. Assuming all the leads and track to be perfectly clear and free from any grease etc., you can start soldering the appropriate pads.

The tip of the soldering iron should aways be wiped on a wet sponge or cotton cloth before making a small group of joints to remove the dross and old flux which might otherwise contaminate them. When making a joint, bring the tip in contact with both the lead and the printed circuit pad to heat them; then apply the solder as shown in Fig10. Just enough solder to surround the pad and lead and leave a smooth bright joint as in Fig.11.

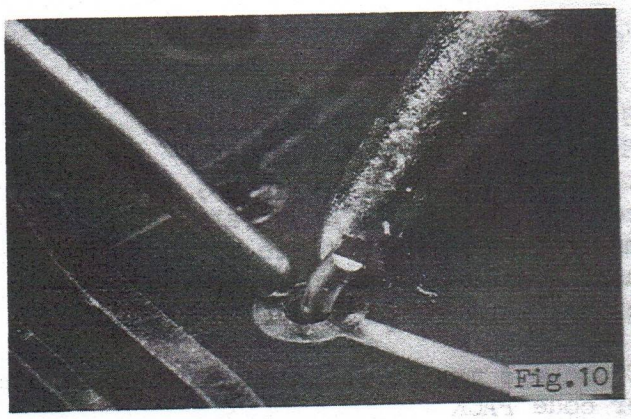


Fig.10

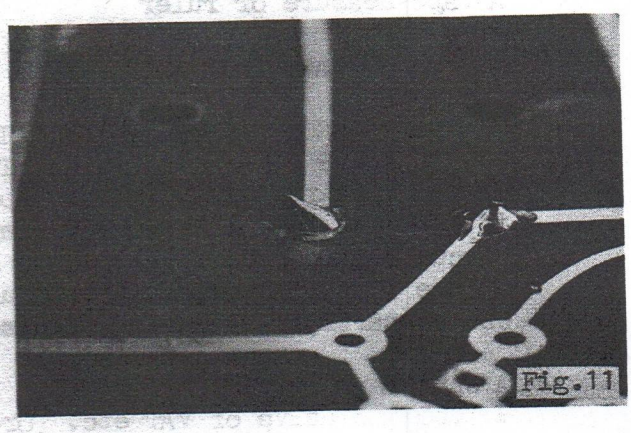


Fig.11

If too little heat is applied to a joint, the solder will form a poor uneven shape and may also be 'dry'. A dry joint will not make a satisfactory connection and may even be intermitent, giving very poor reliablity.

If too much heat is applied to the joint, the solder will crystalize and the joint will look dull and grainy and the track or pad on the printed circuit board may peel off. This damage may be repaired by cutting of the peeled track or pad, then scraping clean the adjoining track. The lead of the component at the damaged site should be bent over hard at right angles on the surface. Then the lead and undamaged, cleaned track can be linked by soldering in a piece of bare wire.

If the components lead is moved whilst the soldered joint on it is still cooling, the joint must be reheated, else a dry joint will form.

Modern silicon transistors and diodes and also integrated circuits are quite robust as regards damage by heat. Even so, when making a joint to one of these devices or any resistor or capacitor etc., the soldering iron should not be in contact any longer than 5 seconds.

When making joints between wires and tags the stranded wires (having been carefully stripped so as not to nick or cut off any of the strands), should first be tinned. The method of tinning is shown in Fig.12. The strands of the wire are first twisted together then brought in contact with both the tip of the iron and a little solder. Just enough solder to wet the strands and hold them together should be applied. The wire(s) should then be hooked with long nosed pliers and crimped to the appropriate tag. The joint may now be soldered taking the care as previously described.

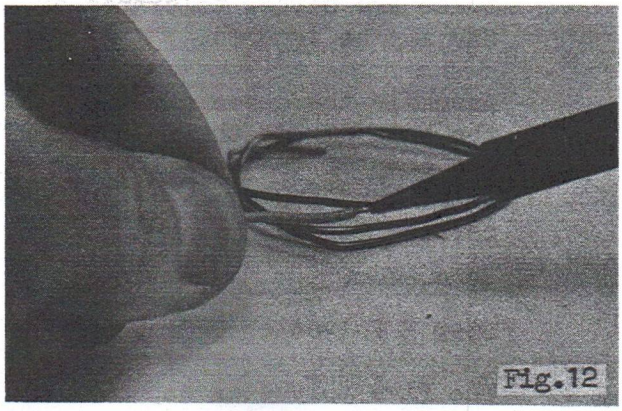


Fig.12

PRINTED CIRCUIT BOARD ASSEMBLY

Step 1 Resistors.

Take the resistors out of Pack 1 and check them against the resistor parts list. All of these with the exception of R46,(22K ohm), are to be assembled on the P.C.B. (Printed Circuit Board). Sort out a 22K ohm (RED RED ORANGE GOLD) resistor and put on one side ready for the switch S2 assembly stage later on.

Taking the resistors in strict numerical order, as shown in the parts list (ie: R1 , R2 , ...etc.) insert them in the appropriate locations as shown on the printed top side of the printed circuit board. The leads of the resistors should be bent downwards , preferably with long nosed pliers to suit the hole spacings.All the resistors except R48 lay down on the board as shown in Fig.13 . After the wires are pushed through the board, bend them over at roughly 45^{o} and then clip them off with wire cutters as shown in Fig. 8 . There is no special way round for resistors but it is easier to check the colour codes if the tolerance bands (gold or silver) are all pointing the same way round, either all pointing down (south) or right as appropriate.

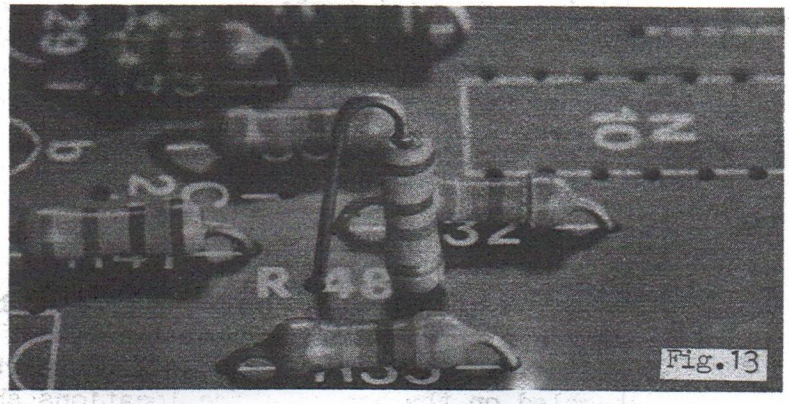


Fig.13

Step 2 Ceramic Capacitors

Sort out the capacitors in Pack 2 into 3 groups:- Ceramic, Polyester and electrolytic. Take the ceramic capacitors and sort these out into those of the same value ie: 100pF 330pF 4.7nF and 10nF. Dependent on the particular brand supplied, they may differ in size and/or shape from those illustrated. Also the printed value on the body may also vary in the code used. The four different values may be identified as follows:

100pF	100p	or	n10				
330pF	330p	or	n33				
4.7nF	4700p	or	4n7	or	.0047uF	or	472
10nF	10000p	or	10n	or	.01uF	or	103

There may also be other numbers and/or letters printed on the capacitors these are either tolerance or makers type codes or date or batch codes and may be ignored.

Assemble the ceramic capacitors on the P.C.B. in numerical order in the same way as the resistors. Take care not to strain the leads with the body of the capacitor or chip or break the ceramic material by rough handling or excessive force. There is no special way round for ceramic capacitors.

Step 3 Polyester Capacitors

The five polyester capacitors are all the same value : 0.1uF (=100nF). These are of a dip coated type and colour coded :

BROWN BLACK YELLOW WHITE

Never try to bend the leads outwards else they break off from the capacitor body. Simply insert each on the five capacitors in each of the positions C21, C24, C25, C27 and C31 straight down on the board. Again, there is no special way round and the leads should be bent at about 45° prior to cropping.

Step 4 Electrolytic Capacitors

The five electrolytic capacitors are all polarity sensitive; they must be assembled 'the right way round'. The printed top side of the P.C.B. clearly shows the positions for C16, C22, C28, C29 and C30 and the polarity with a + sign. Some types of electrolytic are clearly marked to show the + and - leads, some just the - (negative) lead and sometimes no actual + or - sign is printed (axial types). When the capacitors leads come out either end, (ie: an axial type) the lead attached to the CAN of the capacitor is the - (negative) and the lead going through the dark coloured seal is the positive. If axial types are supplied, the negative lead (CAN) should be bent round to run down the side of the body as shown in fig.14. However, usually printed circuit types will be supplied. Carefully check the printed value on the body of the capacitor with the parts list before inserting it in the board, positive lead to + sign, negative lead to unmarked hole. Bend and crop leads as before.

Step 5 Wire links.

By now you will have collected a fair number of croppings from resistor and capacitors which can be put to good use. Select 12 clean long wires and bend the ends over just half an inch apart as shown in fig.15. These are then assembled on the board in the locations shown by dotted lines, 12 in all. Save a few more straight wires for later stages.

Fig.14 An Axial Electrolytic

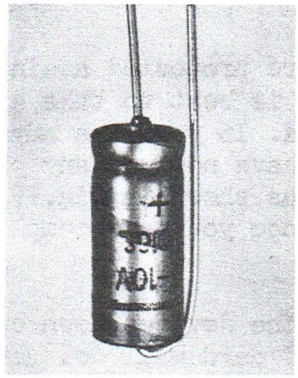
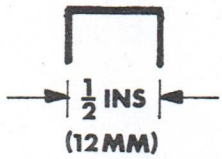


Fig.15 Wire Link



Step 6 First Soldering Stage

At this stage in the assembly the majority of the passive components have been assembled on the board and the leads cropped. In order to stop any falling out whilst the board is being finally assembled the components now on the board should be soldered in. Take care not to use to much solder where a lead is near a P.C. pad not yet occupied, else the adjacent hole gets 'filled in'.

A filled in hole may be cleared either with a solder sucker or by heating the solder to be removed, then quickly wiping away the excess with a cotton cloth.

Step 7 Diodes and Transistors

The 11 diodes used on the P.C.B. all point North - South with the + end (CATHODE) pointing North. The leads of the diodes should be carefully bent with long nosed pliers prior to assembly. Avoid bending the leads too close to the glass body of the diodes else they crack. The + end is marked with a broad yellow band (or in certain cases a Black or Red band). Ensure each diode is put in with the + end (Cathode) in the hole marked + .

The lead configurations for the different transistors supplied are shown in fig.5. The P.C.B. is printed with the lead designations E (emitter) B (base) and C (collector) for each of the 4 transistor locations. Check the type number of each device with the parts list and the lead arrangement with the location to be assembled. Push in the three leads having bent them outwards to correspond to the 3 holes marked E B C. Check again before bending and cropping the leads.

Transistor T2 is the most tricky since its leads are not in E B C sequence its correct positioning is shown in fig.17.

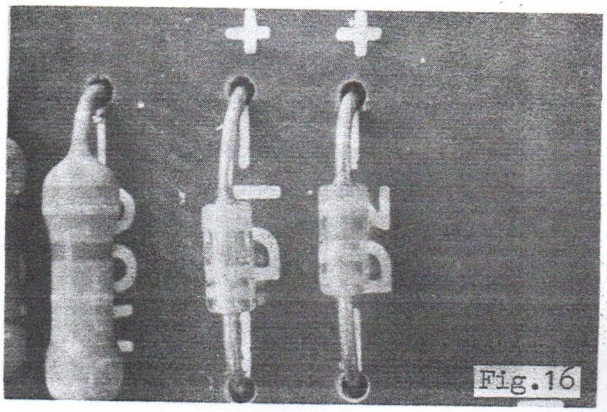


Fig.16

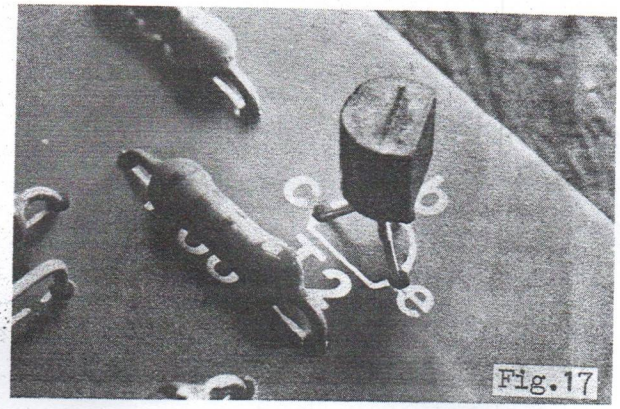


Fig.17

Step 8 Integrated Circuits

The CMOS devices supplied with the VIDEOMASTER kit are protected against accidental damage by static electricity. Even so, it is best to take a few simple precautions to save any possible later trouble. If you have any doubt about the earthing of your soldering iron or if you have not had any previous experience with soldering in IC's, then use sockets as shown in Fig.18, in place of the actual devices, then plug in the IC's once you have completed the construction.

Before assembling the IC's check that you don't put the devices down on a plastic surface, a metal tray is ideal but a piece of card will do. Always touch an earthed point, such as a water pipe or tap or metal exterior of any earthed electrical appliance which is plugged in, though not necessarily switched on, (ie: an electric kettle etc) before handling the IC's. This will discharge any static electricty with which your body may have become charged, perhaps due to a nylon carpet or brushing past furniture.

Nylon clothes can also be a source of static and should not be worn, although it is quite safe to wear any nylon underclothes.

Check that the 'legs' of each IC are true and straight. If not, they may be carefully bent with long nosed pliers. The parallel rows of legs are usually splayed out slightly wider than the holes in the P.C.B. So gently push the IC down on a hard surface as shown in Fig.19 on each side of the device to close the distance between the legs to fit the board locations (the leg rows should be 0.3 inches or 7.5mm apart).

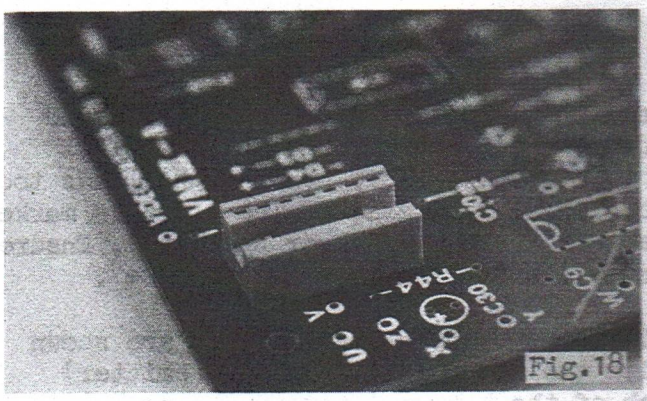


Fig.18

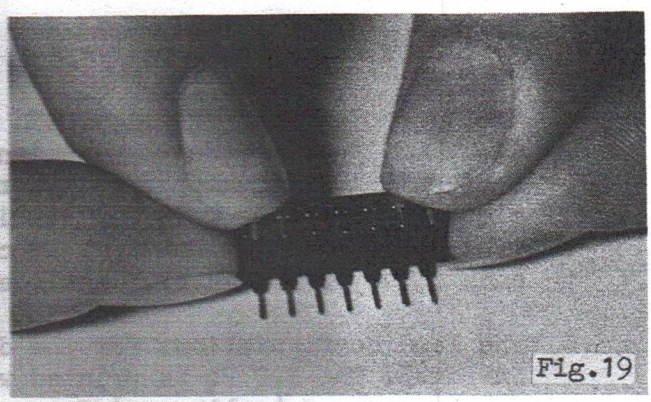


Fig.19

The devices are polarity marked at one end of their top surfaces at the top left hand corner with a small hole. The larger depression which may occur at both ends should be ignored as these are only molding marks. All the IC's are mounted the same way round, as shown on the printed side of the board, with the marked end pointing 'north' as shown in Fig.20.

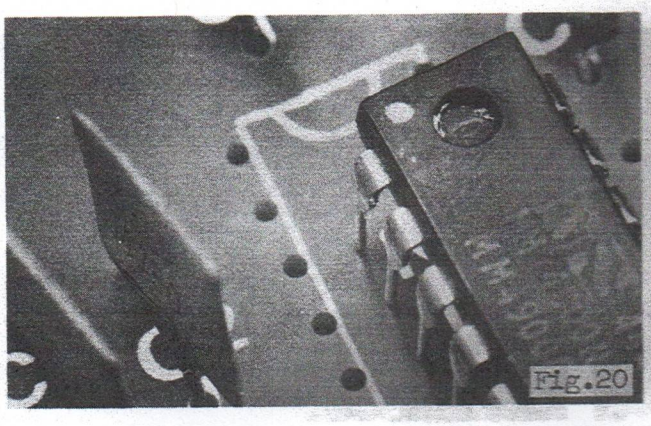


Fig.20

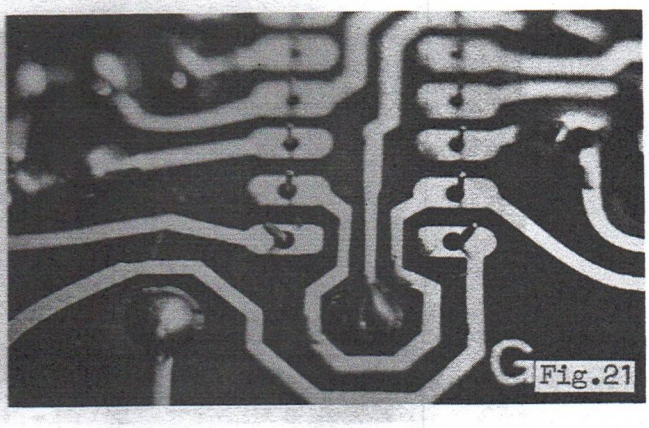


Fig.21

When inserting the devices note that the first 3 IC's N1, N2 and N3 are a different code number from the other 8, ie: MM74C00N. When fitting the devices on the board be careful not to accidentally fold any leg up underneath the body by forcing when all the legs are not properly located in the holes. Once each device is correctly fitted on the board and pushed down firmly just bend the two legs at either end outward very slightly (no more than about 30°) in order to stop it falling out again before being soldered in. If the legs are bent too far over it might make it very difficult to remove the device if in the unlikely case, you had to remove it.

Once all the IC's are fitted on the board it's a good idea just to check each position with the part number and type of IC and also the correct way round. All being well you can turn the board over and solder in all the IC's. When soldering the IC's (or sockets, if you are fitting them), take care not to bridge the IC pads or the track running between some pads with excess solder. If this is done, then the excess is best cleared away with a solder sucker and iron, or by the very careful use of a sharp blade to cut away the solder (but not the track).

Step 9 Pots and sockets

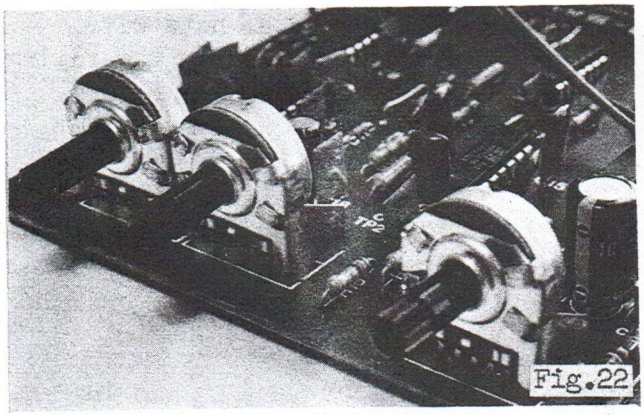


Fig.22

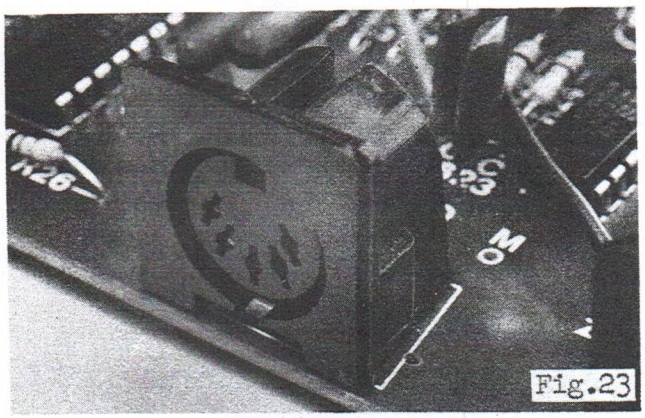


Fig.23

The two picture hold control pots VR1 and VR2 and the ball speed control pot VR3 are mounted directly on the P.C.B. as shown in Fig.22. Check the value of each pot, stamped on the back, with the parts list before locating on the board. Note that VR3, the ball speed control is 100K ohms. The two P.C. mounted DIN sockets are simply plugged in on the SKT1 and SKT2 locations.

Solder in the pots and sockets having ensured that all are pushed firmly home on the board.

Step 10 Fitting the R.F. Modulator

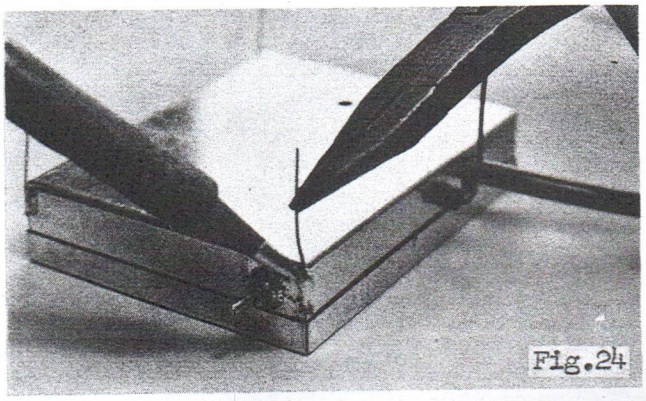


Fig.24

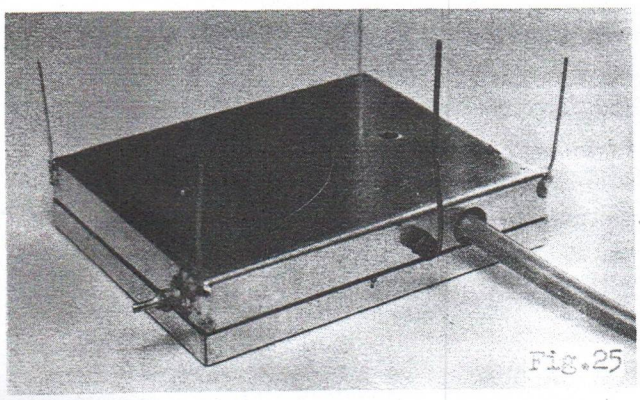


Fig.25

The ready built and tested R.F. modulator is the last component to be soldered on the board. In order to do this four pieces of bare wire from the croppings, each about 1/2 inch long must be soldered onto the extreme corners of the modulator can as shown in Fig.24. When fitting the modulator on the board ensure that the input lead is bent downwards into hole C taking care not to strain it. Bend over the leads, crop and pressing the modulator firmly down on the P.C.B., solder it in. Taking another piece of the bare wire about an inch or more in length, make a small hook at one end. The hook is fitted to the modulator power input terminal +V and the end of the wire pushed down hole B. This link is first soldered on the modulator +V terminal. Take care not to keep your iron on too long when making this joint else you overheat and damage the modulator's internal circuitry. Then crop and solder the other end of the link on the board.

Step 11 Battery retainer bracket

The Battery retainer bracket is bolted on the P.C.B. just to the rear of the battery space. Two 6B.A. bolts are pushed through from the track side of the board and the bracket is secured with two 6B.A. nuts with washers. The P.C.B. assembly should now be complete (except for the flying leads) as shown in Fig.26.

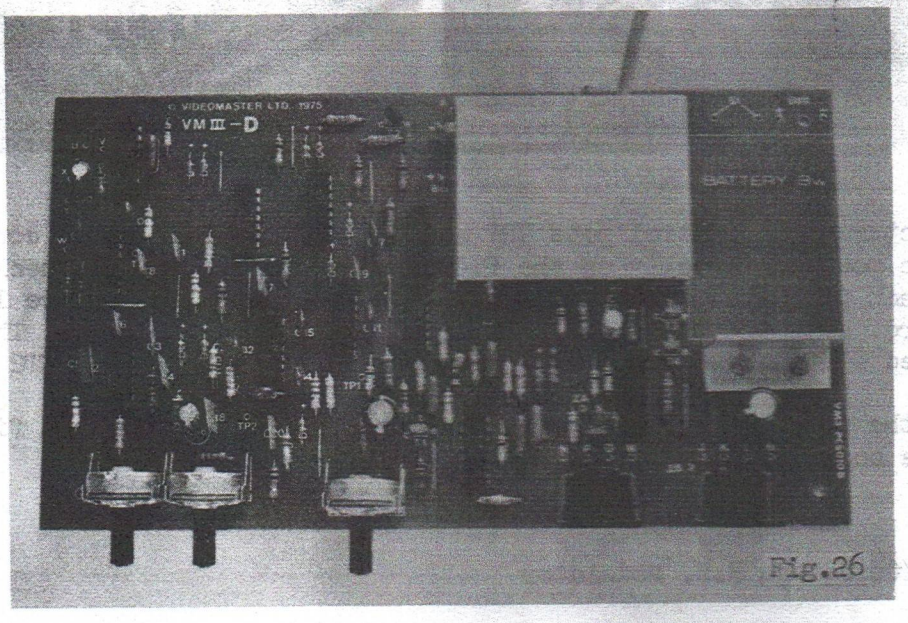


Fig.26

Step 12 Wiring Schedule

Cut the lengths of stranded wire supplied to the following table and strip the ends of each piece 1/4 inch (6mm) from either end. Lightly tin the ends as shown in Fig.12 to prevent fraying before use.

Battery leads:

COLOUR	LENGTH INCHES	LENGTH m.m.
RED	3	75
BLACK	3	75

S1. ON/OFF Switch leads

PINK	7-1/2	190
PINK	7-1/2	190

S2 Game Selector Switch leads

BLACK	14	350
BROWN	8	205
RED	13-1/2	340
ORANGE	8-1/2	220
YELLOW	7	180
GREEN	7	180
BLUE	7-1/2	190
GREY	8-1/2	220
WHITE	7-1/2	190

Hand Control Units

PINK	3	75
PINK	3	75

Also for each unit one length 4 core cable, stripped as follows:-

Plug End	3/4 inch	20 mm
Box End	2 inches	50 mm
Each of the 4 cores	1/4 inch	6 mm , each tinned.

The screen braid, (if fitted) is twisted and tinned at the plug end and cut off at the box ends of the cable; see Fig.30. No electrical function is served by this screen.

Step 13 Battery Leads

The 3 inch (75mm) RED and BLACK leads are soldered to the appropriate battery connectors. The RED positive lead goes to the castelated female stud; the BLACK negative lead goes to the plain male stud. The prepared leads are then soldered on the board in the Batt + and - locations. The RED leads goes to the + hole, the BLACK lead goes to the - hole.

Step 14 Fitting and Wiring the Switches

The two slide switches S1 and S2 are bolted onto the inside of the plastic cabinet's lid using the 8B.A. nuts, bolts and washers as shown in fig.27.

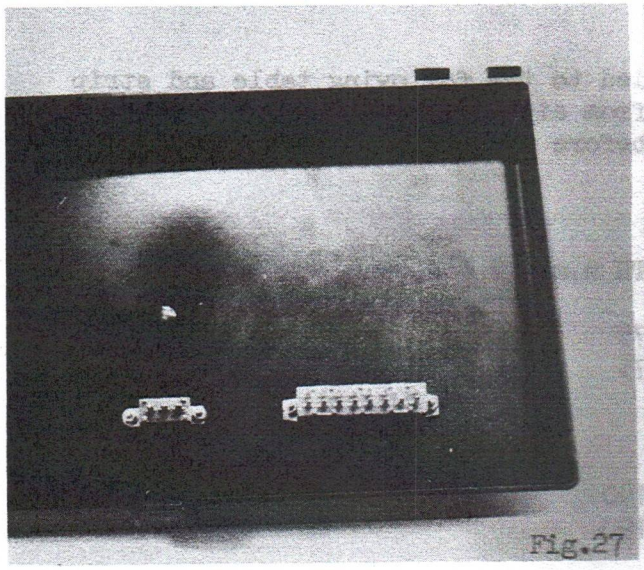


Fig.27

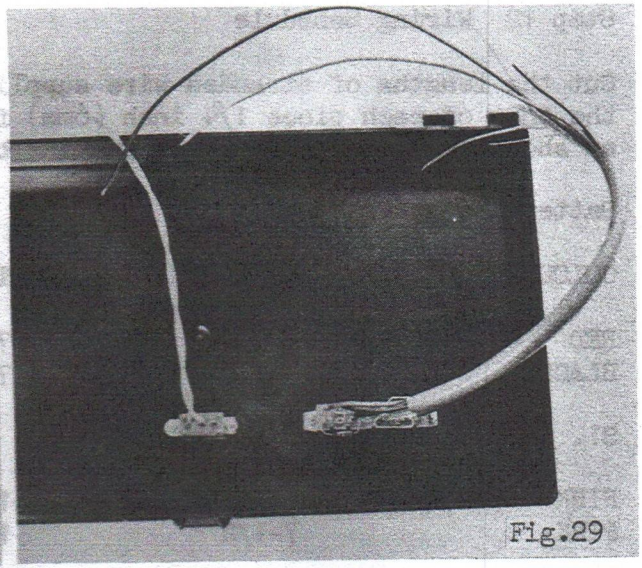


Fig.29

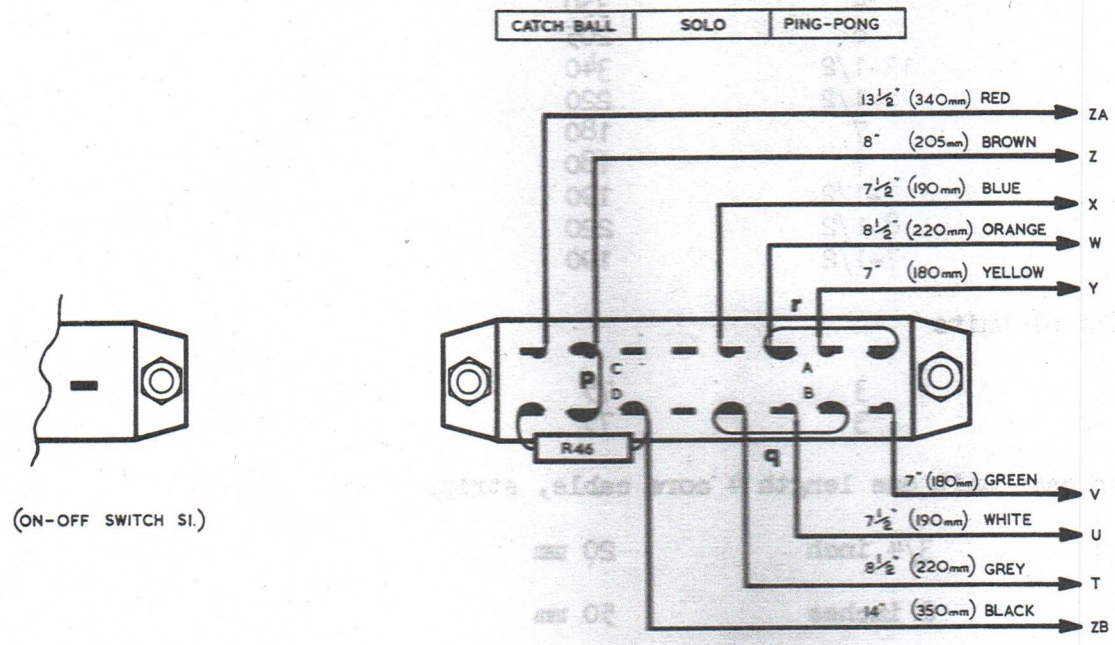


Fig.28 REAR VIEW OF SWITCH S2.

The 3 bare wire (croppings) links and R46 (22K.ohm RED RED ORANGE GOLD) are cut and bent to mount on S2 as shown in Fig.28. [Links marked p q & r] Squeeze on the hooks bent at the ends of the leads over the tags to retain them prior to soldering. Fit each of the 9 wires to S2 as shown. Solder the wires, resistor and links having doulble- checked against the switch wiring diagram. All 9 wires are fed through the length of large bore sleeving. Push the sleeving right up as far up to the switch as possible and make sure all the wires have come through and not become caught up inside the sleeve.

The two 7-1/2 inch (190 mm) PINK wires are attached and soldered onto the ON/OFF switch S1 as shown in Fig.29. These are then loosely twisted together for neatness.

Step 15 Wiring the Switches to the P.C.B.

The destinations for all the wires to the switches are shown in Fig.28. These holes are all identified on the P.C.B., T , U , V , W , X , Y , Z ZA and ZB for S2. The two pink wires from S1 are first inserted in the holes marked S1 (no special way round) and soldered in.

Next the two longest wires to holes ZA and ZB from S2 should be soldered in, followed by those to V, U, Z, X, Y, W and T. Watch out for stray strands which may have frayed out of the ends and not gone into the holes, as they might otherwise cause short circuiting.

The main assembly should now be complete and every single soldered joint should be closely examined for integrity. Also check that no bridges have occurred across any tracks or pads. A really thorough inspection at this stage may very well save you hours of trouble later on, discovering any mistakes the hard way.

Step 16 Wiring on the DIN plugs.

The DIN plugs may be taken apart by pressing in the metal clip through the hole in the top of the plastic shroud with a small screwdriver whilst pulling the metal parts with long nosed pliers. The plastic shroud is slid over the stripped end (3/4inch or 20mm) of the four core cable and the cores are then soldered onto the pins as shown in Fig.30. If the cable supplied is of a screened type, the braid is soldered onto the centre pin (2) only to provide extra anchorage. Be careful not to overheat the braid and melt the insulation on the cores causing them to short out. Before re-assembling the plug, crimp over the cable clamp using pliers to pinch the cable tight.

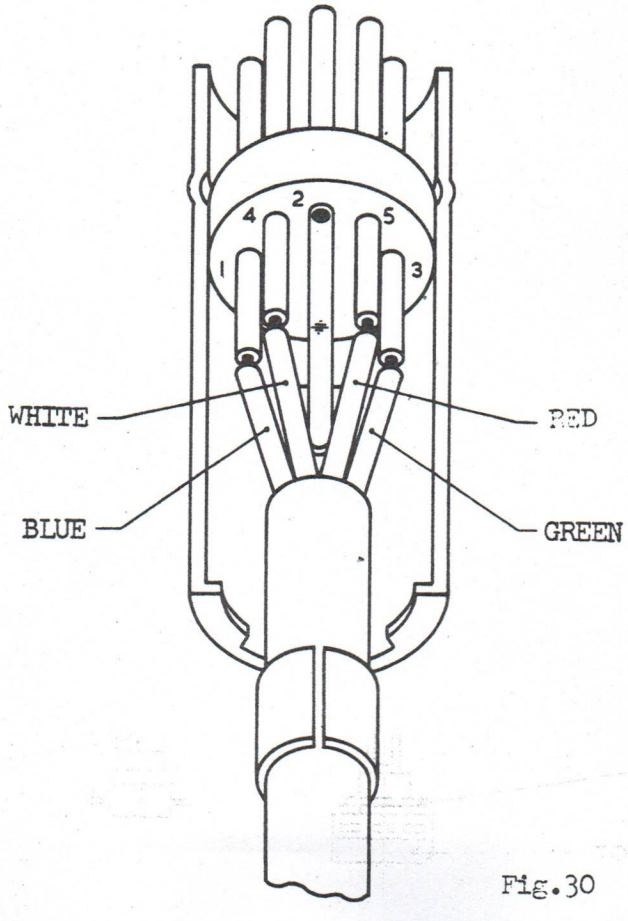


Fig.30

To re-assemble the plug, hold the two metal parts in position whilst sliding back the plastic shroud over them, making sure to locate the metal clip in the hole in order to retain the the parts firmly together. Both the leads for the two control units are prepared in the same way and the plugs wired the same way.

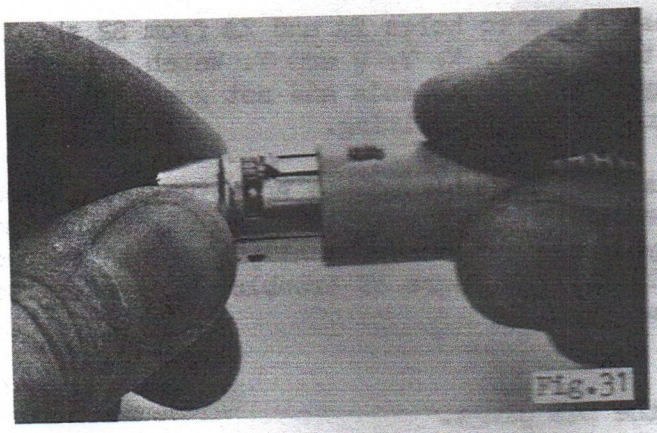


Fig.31

Step 17 Assembling and Wiring Hand Control Units

Each of the two player control units in constructed identically. Assemble the 22K.Ohm pot and push button onto each panel as shown in Fig.32. The pots are secured by tightening the nut at the rear of the panel once the nut on the topside has been turned by hand such that it is flush with the top of the pot's mounting bush. The push button is secured by holding the button at the rear and tightening the plastic ring on the topside by hand.

The stripped ends (2 inch or 50mm) of the four core cables with plug are fed through the holes of the control boxes and a simple knot tied 4 inches (100mm) from the end to prevent the cable pulling back through the hole. The front panels are then each wired up as shown in Fig.33 using the 3 inch (75mm) PINK wires already prepared.

Once the panel has been soldered up and the wiring double-checked, fit the panels in the control boxes and secure in each of the 4 corners with the self tapping (+ Head) screws supplied. The control knobs simply push over the pot spindles once the flats on the shafts have been located.

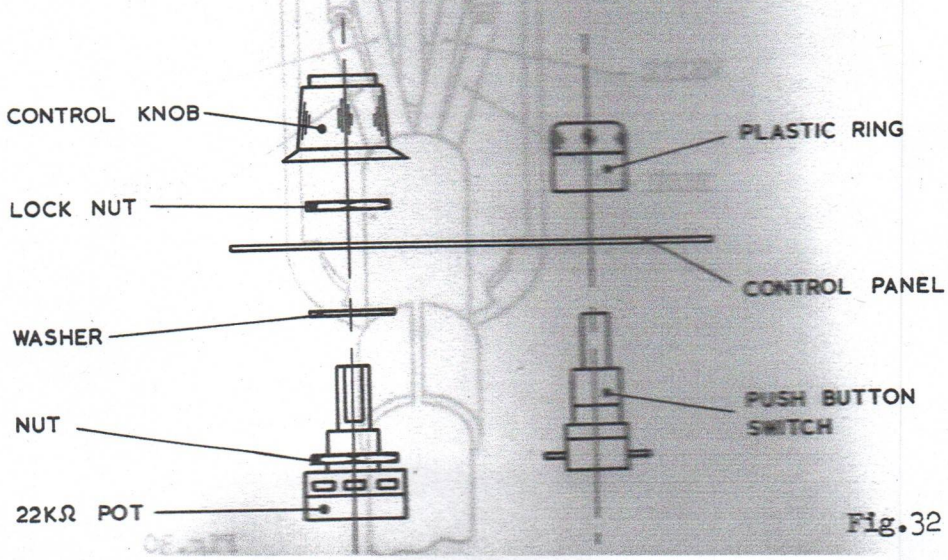


Fig.32

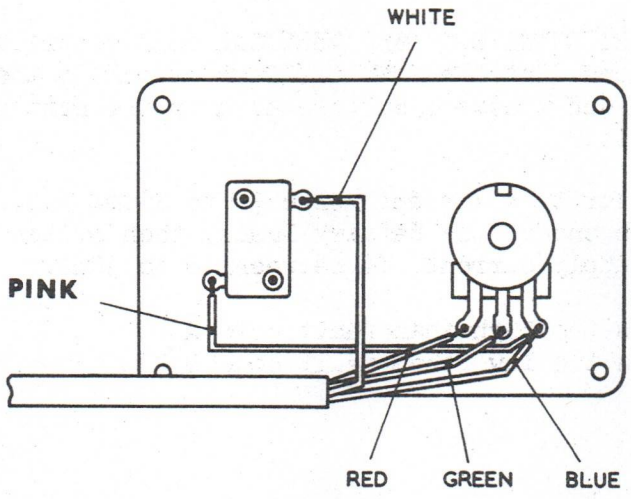


Fig.33

You should now be all set to start testing your VIDEOMASTER. The final assembly stage, when the printed circuit board is housed in the plastic cabinet comes later, after the unit has been fully tested. Till then, be careful not to strain or break off any of the flying leads to the board and keep your fingers off as well as any moisture etc. off the P.C.B.

TEST PROCEDURE

Equipment Required: Suitable TV Set and new P.P.7 type 9 Volt battery

This test proceedure is designed to test all the functions on the Videomaster unit. For each check made there is a corresponding fault code if the unit fails the test or check. The fault codes are listed under the FAULT FINDING section, together with the most likely reasons for failure. Whilst this list and the test proceedure is comprehensive, they are not exhaustive, and any other faults you might find, (which are very unlikely) would come under fault code Z or miscellaneous.

Before starting the test proceedure, just check once more that all the integrated circuits are round the right way, then switch on your TV set after plugging in the Videomaster lead in the aerial socket and plugging in the hand control units into the P.C.B. DIN sockets.

NOTE:
During the testing of the Videomaster and during normal operation the TV set's own HORIZONTAL HOLD and VERTICAL HOLD controls should not be re-adjusted from their normal positions for normal TV broadcast reception. The same applies to any other preset controls such as HEIGHT, VERTICAL LINEARITY, WIDTH etc. However the BRILLIANCE and CONTRAST controls may be adjusted for best results, the volume control is best kept at minimum.

The battery should not be clipped into the unit with the ON/OFF switch in the ON position, else the circuitry will fail to start up properly. So only switch on the unit with the actual ON / OFF switch. (See circuit desciption for explanation.)

Test 1

Set the units HORIZONTAL HOLD and VERTICAL HOLD controls to roughly their mid positions. Set the GAME SELECTOR switch to the 'CATCH BALL' position. If you don't have a multimeter skip the next paragraph and switch on the unit.

Set your multimeter to a current range 30 to 250mA F.S.D. and connect it in series with one of the battery leads, then switch on the unit. Chech that the supply current is between 10 to 30mA.

If the current is too high then fault code A
If the current is too low then fault code B

Test 2

Tune in the TV set in the usual way for your set, looking for a pattern or picture from the unit.

If you cannot find any signal from the unit then fault code C.

Test 3

Use the units HORIZONTAL HOLD control to synchronize a flickering diagonal pattern and the VERTICAL HOLD control to synchronize a 'rolling bar/picture. Some retuning may be necessary at this point in order to establish a stable picture. Set the player control knobs fully clockwise for the time being.

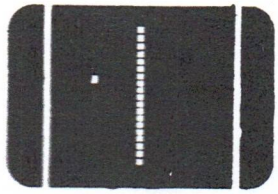


Fig.34

If you cannot stabilize the picture then fault code D
If the picture does not look like Fig.34. then fault code E

Test 4

Set the 'BALL SPEED' pot (VR3) to maximum; ie: fully clockwise. Press the service button on the left hand control unit. If no ball appears after 10 seconds, then press the right hand player's service button. If the ball has not yet appeared after a short while then switch off the unit and try the proceedure a second time. The ball should remain on the screen, trapped between the two vertical walls.

Check the following:

	OK (tick) if not	FAULT CODE
The ball comes on the screen		F
The ball is a small square or rectangle		G
The ball does not go through left wall		H
The ball does not go through right wall		J

Test 5

With the ball bouncing between the two walls, reduce the speed control progressively down to minimum (fully anti-clockwise). The ball speed should slow down considerably, if it does not, then fault code K.

Test 6

During the course of tests 4 and 5 the ball should have been seen to bounce up and down as well as moving across the screen. If it has not been seen to do this, then encourage it a little by rapid movement of the left hand player control as it hits the left hand wall or the right hand player control when it hits the right hand wall. The 'holes' in the walls as illustrated in Fig.35 for the CATCH BALL game should appear as the controls are operated. Should the ball go through a hole, then it will have to be retrieved by pressing the service button on the opposite side control unit to which it disappeared.

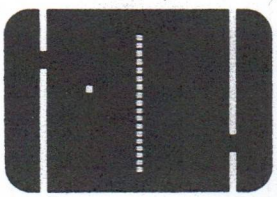


Fig.35

Check the following:

	OK (tick)	if not	FAULT CODE
The ball is free to move up and down	| |		L
The ball bounces at top of the screen	| |		M
The ball bounces at bottom of the screen	| |		N
The hole in the left hand wall is found	| |		P
The hole in the right hand wall is found	| |		Q
Both holes move up & down on their own	| |		R
Both the holes are roughly the same size	| |		S
The left hand control moves the left hole and vice versa	| |		T

Test 7

Switch game selector switch to PING-PONG. Check picture looks like Fig.36, with two bats where the holes were in the CATCH BALL game.

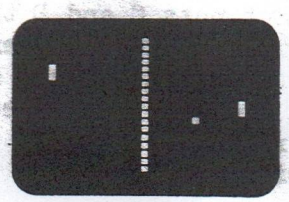


Fig.36

Check the following:

	OK (tick) if not	FAULT CODE
Both bats appear (adjust player controls to centralize their position)	| |	U
Both bat can be moved up and down from the top & bottom of the net or beyond	| |	V

Test 8

Switch game selector switch to SOLO. The picture should appear as in Fig.37 . If not then fault code U. The hole in the wall on the right hand side may be moved up and down by the right hand player control but should also move quite rapidly up and down on it's own.
If hole does not move up and down then fault code W

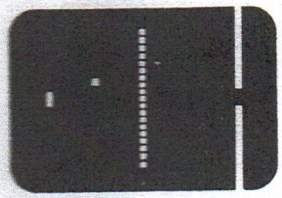


Fig.37

Test 9

Switch back the game selector switch to CATCH BALL and trap the ball between the walls as previously described, then check the following:

When the ball hits the left hand wall as the left hand control is being rotated clockwise, it rises:

YES | | if not, FAULT CODE X

When the ball hits the right hand wall as the right hand control is being rotated clockwise, it rises:

YES | | if not, FAULT CODE Y

Final Assembly

Assuming all the tests have proved satisfactory then the P.C.B. may be fitted in the plastic cabinet. The rubber feet are first fitted on the bottom part of the cabinet as seen in Fig.38. The 6B.A. securing bolts are pushed through the feet up into the box and 6B.A. retaining nuts screwed up. The two rear nuts shown as A and B are only done up finger tight. The two front nuts are left only half way down the protruding bolts.

The board is now fitted in the bottom half of the cabinet, making sure that the pot spindles locate properly through the front and all four securing bolts locate through the board. By pressing the board down hard on the loose front nuts C and D the bolts may be screwed up by turning the feet clockwise; finger tighten only. The retaining nuts and washers (6B.A.) can be fitted on bolts A and B. The two tapped pillars are firmly screwed down on C and D, tightened with the aid of pliers. Tuck the co-axial lead from the modulator through the slot provided in the rear of the cabinet.

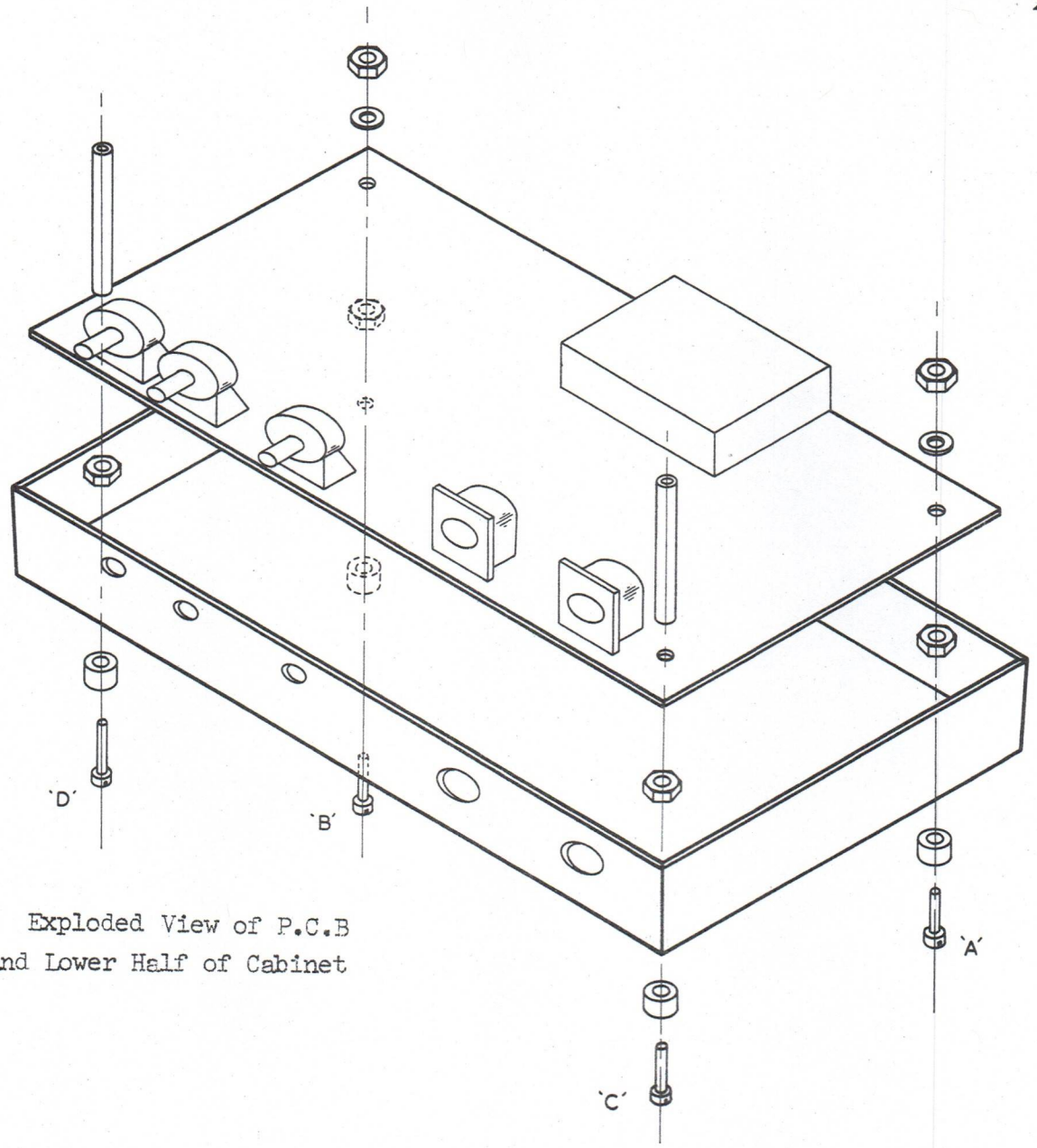


Fig.38 Exploded View of P.C.B and Lower Half of Cabinet

The two halves of the plastic cabinet are mated together by means of two hinges at the rear edge. Insert the two brass hinge pins in the top halves left hinge and bottom halves right hand hinge. The two halves are then drawn together in order to mate the hinges and the hinge pins gently tapped home with the handle of a screwdriver or similar light object.

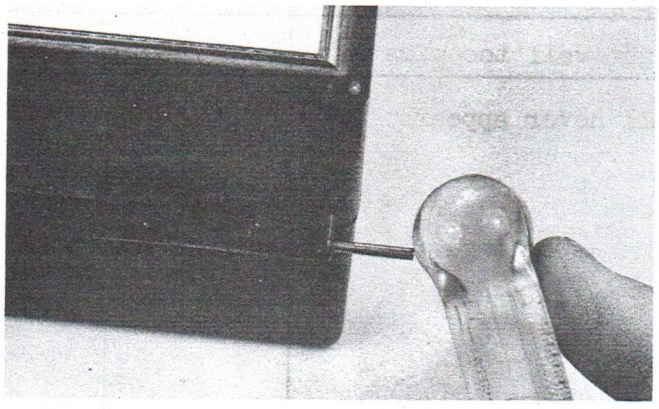


Fig.39

Once the battery has been fitted the lid may be secured down by means of the two bright plated short 6B.A. bolts through the holes provided in the lid into the pillars below. Now you are a set to have some fun and games.

FAULT FINDING

The following list of fault codes coresponding to those given in the test proceedure should enable you to locate the most likely areas for a particular fault. In general, look for short circuits (s/c) and open circuits (o/c) around the likely areas indicated. The more experenced will be able to make use of the circuit diagram, block diagram and circuit description given later. For those who get stuck, VIDEOMASTER Ltd. can service and correct their unit for a modest fee. (See P.36)

FAULT CODE	SYMPTOM(S)	POSIBLE FAULT AREA(S)
A	High supply current	IC(s) wrong way round s/c on track Control unit's) incorrectly wired C28 wrong way round Damaged modulator
B	Low or zero current	Check battery Wire link's) on PCB o/c Switch S1 o/c Track's) o/c on PCB Missing components
C	No signal	See A and B (test 1) TV set and modulator not in same band.eg: VHF set and UHF modulator +V connection to modulator o/c damaged modulator
D	No synchronization	T4, R39 R1 - R5, C1 - C5 R12-R15, C12-C15 R17 & VR1, R16 & VR2
E	Picture not like Fig.34 Moving dots in centre, going top to bottom	C12 - C15, R12 - R15 N3(G6 - 9), N6(G13 & 38) N? (s/c)
	No dots in net	C17, R20, D5, N6 (G13 & 38)
	Left wall missing	C6, R6, D3
	Right wall missing	C?, R?, D4
	Left wall too wide	C6, R6
	Right wall too wide	C?, R?
F	Ball never appears	D6, R11, C11, R48, R35, R23, C22 N5(G19,24), N?(C30 & 37), N?(G39&40) N10(G31 32), D7, D8, D? D10, C1?, R19, C20, R21 C29, R20, VR3, C19, R18 T1, R41, R42, R43, C27 Push button connections

FAULT	SYMPTOM(S)	POSSIBLE FAULT AREA(S)
G	Ball too long	R11 and C11
	Ball too wide	R18 and C19
H	Ball goes through Lt.Wall	D1, C23, R24, N8(G33,39 & 40) N2(G12)
J	Ball goes through Rt.Wall	D2, C26, R28, N8(G36, 39 & 40) N2(G11)
K	Ball does not slow down	VR3 (100K ohm) s/c VR3 wrong value
L	Ball never moves up or down	C21 s/c, R35 o/c, R23 o/c or see X and Y
M	No bounce from top	D8, N9(G21), R34
N	No bounce from bottom	D9, N9(G22), N8(G23),
P	No hole in left wall	VR5 connections, PL2 & SKT2 C9, R32, N6(G27), N10(G28)
Q	No hole in right wall	VR4 connections, PL1 & SKT1 C10, R33, N6(G26), N10(G29)
R	Neither bats move on their own up & down	S2 connections N11(G42 & 43), R44, R45, C30, C31
	Only one bat moves	S2 connections
S	One bat is much larger than the other	Check values of C9 & 10, R7 & 9 N4(G14 & 15)
T	Controls wrong way round	S2 connections
U	Bat missing	S2 connections
V	Bat(s) cannot be moved over breadth of the net	R42, C27, R32, R33, R31, R30 N10(G28 & 29), VR4 or VR5
W	Bat does not move	S2 connections
X	Left strike not working	R25, T2, R24, C23 C24, R26, N7(G34)
Y	Right strike not working	R29, T3, R28, C26 C25, R27, N7(G36)
Z	Miscellaneous faults	Use circuit and block diagrams or see page 36.

HOW IT WORKS

The VIDEOMASTER HOME TV GAME works almost like a miniature TV broadcast system, except that there are no cameras but instead, uses special electronic circuits to generate the images on the screen, and it doesn't cost millions of pounds.

System Blocks

Referring to the block diagram of the VIDEOMASTER VM 3 system opposite, you will notice that the unit contains a number of video generating blocks and a number of control blocks of one sort or another. Most of the generating blocks feed their signals into a device called the video adder which actually combines all the components of the picture together before being passed via the sync adder, to the R.F. modulator.

Putting the Signal into the T.V.

The R.F. modulator, which operates at a U.H.F. (Ultra High Frequency) for most T.V. sets, is a very low power transmitter. It converts the video signal onto a radio frequency carrier (approx 590MHz or 590 million cycles per second) using amplitude modulation so that the set is able to receive this signal through the co-axial cable the same way it would a normal TV station through the aerial cable. [The same applies to VHF sets and VHF modulators except that the frequency used is much lower, only 67MHz.]

Synchronizing the Picture

The VIDEOMASTER generates synchronization pulses by means of two master oscillators called the LINE FREQ. PULSE GENERATOR and the FRAME FREQ. PULSE GENERATOR which enable the TV set's scanning circuits to keep exactly in step with all the video generating circuitry in the unit. These two generators are set by means of the horizontal and vertical hold controls to work at about 15625 Hz and 50Hz respectively; the scanning frequencies for the international & UK 625 line TV standard. Incidentally, these circuits may also be adjusted to about 15750 and 60Hz respectively for the American 525 line system.

Setting Up the Picture

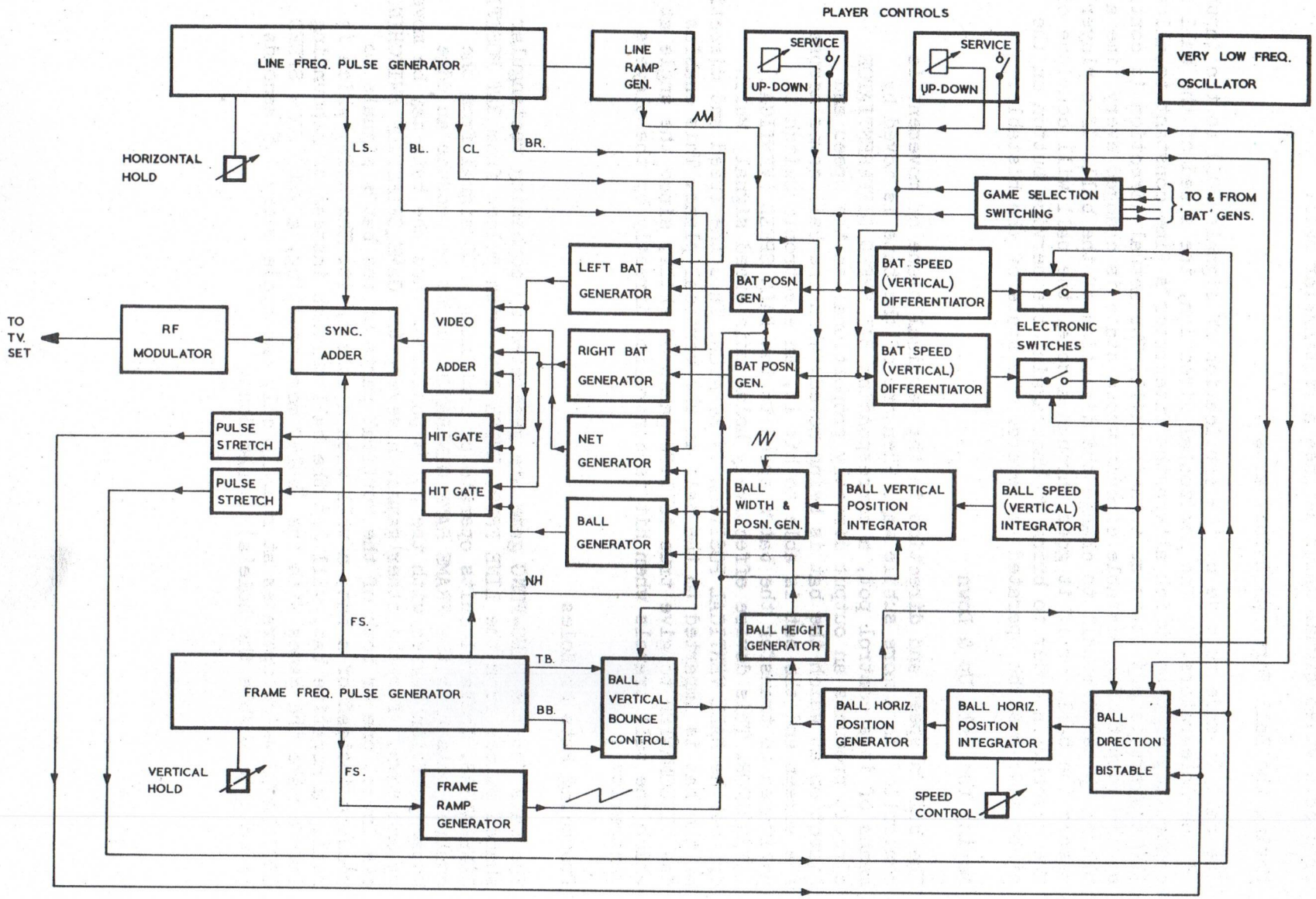
The LINE FREQ. PULSE GENERATOR provides drive pulses which enables the generation of all the fixed vertical elements in the picture; ie: it sets the horizontal position of the two bats (or walls) and the net in the centre.

The FRAME FREQ. PULSE GENERATOR also helps to generate the net by setting its vertical limits. Two pulses are also generated which actually define 'invisible' walls at the top and the bottom of the picture, off which the ball can be rebounded by the BALL VERTICAL BOUNCE CONTROL circuit.

Generating the 'Ball'

The Ball is generated by the combination of two sets of control and generating circuitry. The position of the ball on the screen is controlled by the outputs of the two position integrators. One for the vertical position the other for the horizontal position. The integrator outputs are combined with sawtooth signals from the two ramp generators which are derived from the master oscillators. The position generators are thus able to produce pulses which define the position of the ball in terms of their leading edges position in relation to the respective synchronization pulses. These two edges are in turn, shaped by the BALL WIDTH and BALL HEIGHT GENERATORS to

VM3 Block Diagram



produce rectangular pulses, which when combined in the BALL GENERATOR, produce a video signal which defines a rectangular ball.

Moving the Ball Forwards & Backwards

The ball is made to move by the application of signals (DC) to the inputs of the integrators. In the horizontal direction, the speed of the ball is controlled by a pot which alters the integrator's time constant to allow the players to set it to suit their skill. The actual direction is controlled by the output of a bistable circuit whose state is changed every time a player 'hits' the ball to change the direction of the ball. If a player misses the ball, or if it goes through a hole, the ball will continue off the screen. In order to bring it back again, the service button on the other side must be operated to reverse the state of the bistable.

Moving the Ball Up & Down

The ball's speed and direction in the vertical plane of movement is controlled in a more subtle way. When one of the bats is moved by means of it's control pot, a corresponding BAT SPEED DIFFERENTIATOR circuit produces an output directly proportional to the speed and direction at which the bat is being moved. When the ball comes across the screen and the bat is able to hit it, an electronic switch is activated to transfer the bat's speed to the BALL SPEED (VERTICAL) INTEGRATOR. This device effectively holds this speed signal, which drives the BALL VERTICAL POSITION INTEGRATOR. Thus the speed and direction of the bat is imparted to the ball in the vertical plane. This enables the VIDEOMASTER to give true to life games of skill, since the angle at which the ball travels when hit is controlled directly by the players dextrerity.

Producing Bats or Holes

The bats for the PING-PONG game are generated by combining rectangular shaped pulses from the LINE FREQ. PULSE GEN. with pulses from BAT POSITION GENERATORS. These circuits operate by combining a DC signal from the control pots with the FRAME RAMP GENERATOR output to produce an edge whose position varies with the pot's position. Thus the bats may be moved up and down. For the other games, however, the GAME SELECTION SWITCHING can invert one or both of the vertical parts of the bat's signals to produce instead of a bat, a wall with a hole in it. The hole, which is really a negative bat, will let the ball through instead of rebounding it. To make the games with the 'hole' more exciting, a VERY SLOW SPEED OSCILLATOR which operates at roughly only one cycle every 1.5 seconds, is used to wobble the hole(s) up and down.

NOTES ON CMOS ICs

CMOS is an almost ideal logic family with practically infinite input impedances, fast propagation delays, good noise immunity and very wide supply voltage tolerance coupled with very low power operation at low switching speeds. In addition a simple gate or inverter features a near linear transfer function, as seen below, enabling use as amplfiers when correctly biassed.

two-input NOR gate

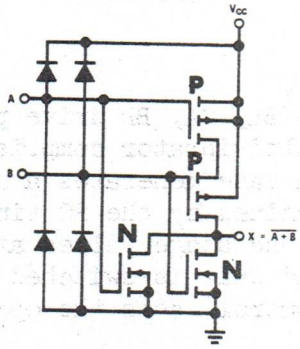
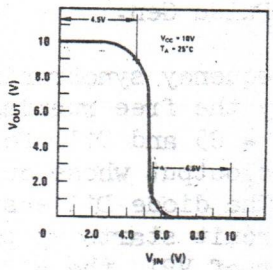


Fig.40 MM74C02.



Typical Transfer Characteristic

Fig.41

The circuit for an individual gate within the National Semiconductors MM74C02N Quad 2 input NOR gate is shown in Fig.40. The inputs A and B, whilst passing through protection networks comprising current limiting resistors and clamping diodes, is virtually purely capacitive. Each input drives the gates of a pair of complementary P and N type enhancement FETs (Field Effect Transistors). Since when both the N type devices are turned on when the inputs are at logic 1 (high), both P type devices are completly off, no significant supply current flow through the devices (assuming the output to be only capacitively loaded), the gate dissipates zero power in this quescent state. The same is true for any logical combination at the inputs. However, when the gate is switched and the output changes state, current is taken from the supply to charge any output load capacitance and as the P and N devices are momentarily both on together during the transition. Hence the supply current is proportional to the switching frequency.

When both inputs to the gate are connected (tied) together, the device performs as an inverter, typically giving a transfer function as in Fig.41. When the input is connected to the output via a resistor, it self biasses itself to the linear region and may be used as an amplifier for use in the differentiator circuits in the VIDEOMASTER or if capacitive feedback is used, as an integrator. A CMOS inverter, due to its steep transitional region, may also be used to 'square up' and buffer (due to the very high input impedance) signals with slow rising or falling edges.

NOTE: Although the pinning and logic function of the 74C CMOS and 74 series TTL are identical, they are NOT ELECTRICALLY INTERCHANGABLE in the VIDEOMASTER VM3 circuit due to the special characteristics and advantages of 74C CMOS. The 4000 series CMOS are also incompatible in this application due to the differences in pinning and characteristics of these devices.

CIRCUIT DESCRIPTION

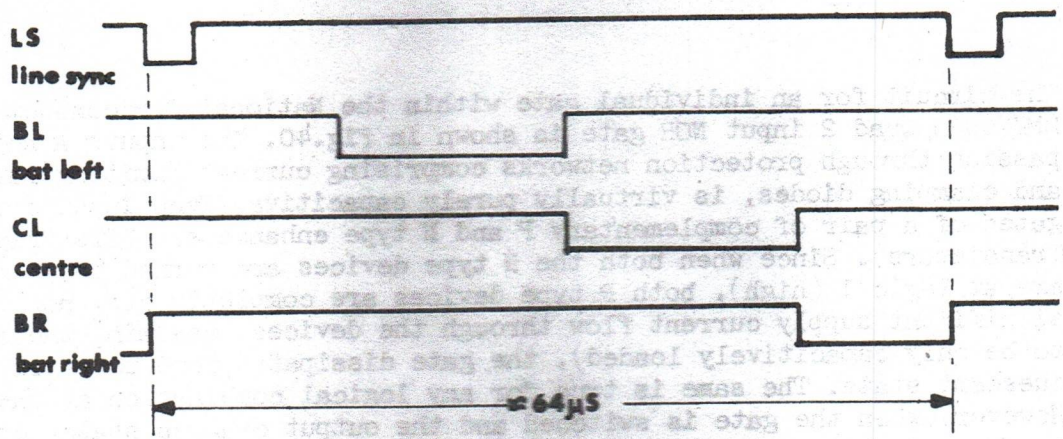
Power Supply

The VIDEOMASTER VM3 is powered by a 9 Volt battery. In order to provide a low impedance source, and especially when the unit is first switched on, a reservoir capacitor is permanently in parallel with the battery. The very low leakage current which flows through this capacitor is negligible, and alone, would not run the battery down much faster than its natural shelf life. Extra supply decoupling is provided by C16.
NOTE: If the battery is replaced with a mains power supply, it must be fully regulated to 6 - 9 Volts and have very low ripple. Also, remember to switch on the VIDEOMASTER after switching on the power supply.

Line Freq. Pulse Gen.

The line frequency synchronization (LS) and BL, CL, BR drive pulses are generated by the free running multistage multivibrator comprising G1 - G5, R1 - R5, C1 - C5 and D11. For each stage, a gate generates a negative going pulse at its output whose duration is determined by the RC time constant at its input. The diode D11 ensures that only one stage pulses at a time and that the circuit starts up properly when the unit is switched on. The voltage on the wiper of VR1, the HORIZONTAL HOLD control, sets the operating frequency, which would normally be about 15625 Hz.

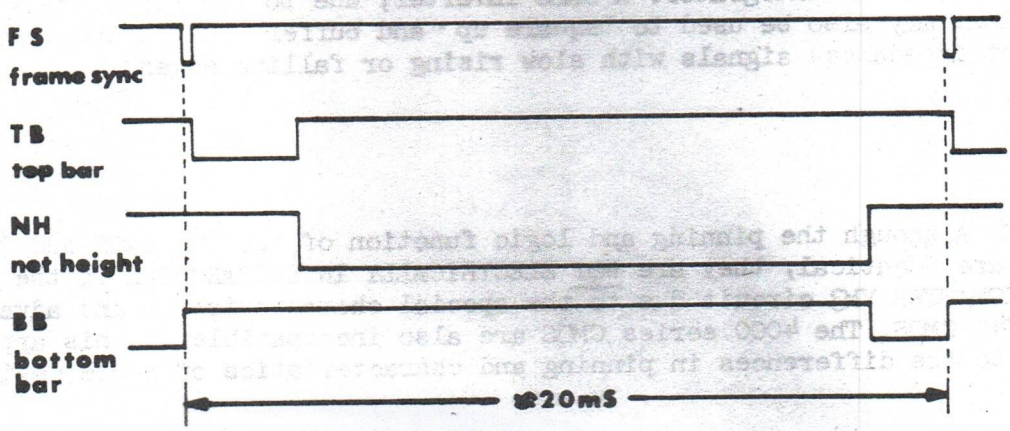
TYPICAL WAVEFORMS OF THE LINE FREQ. PULSE GENERATOR



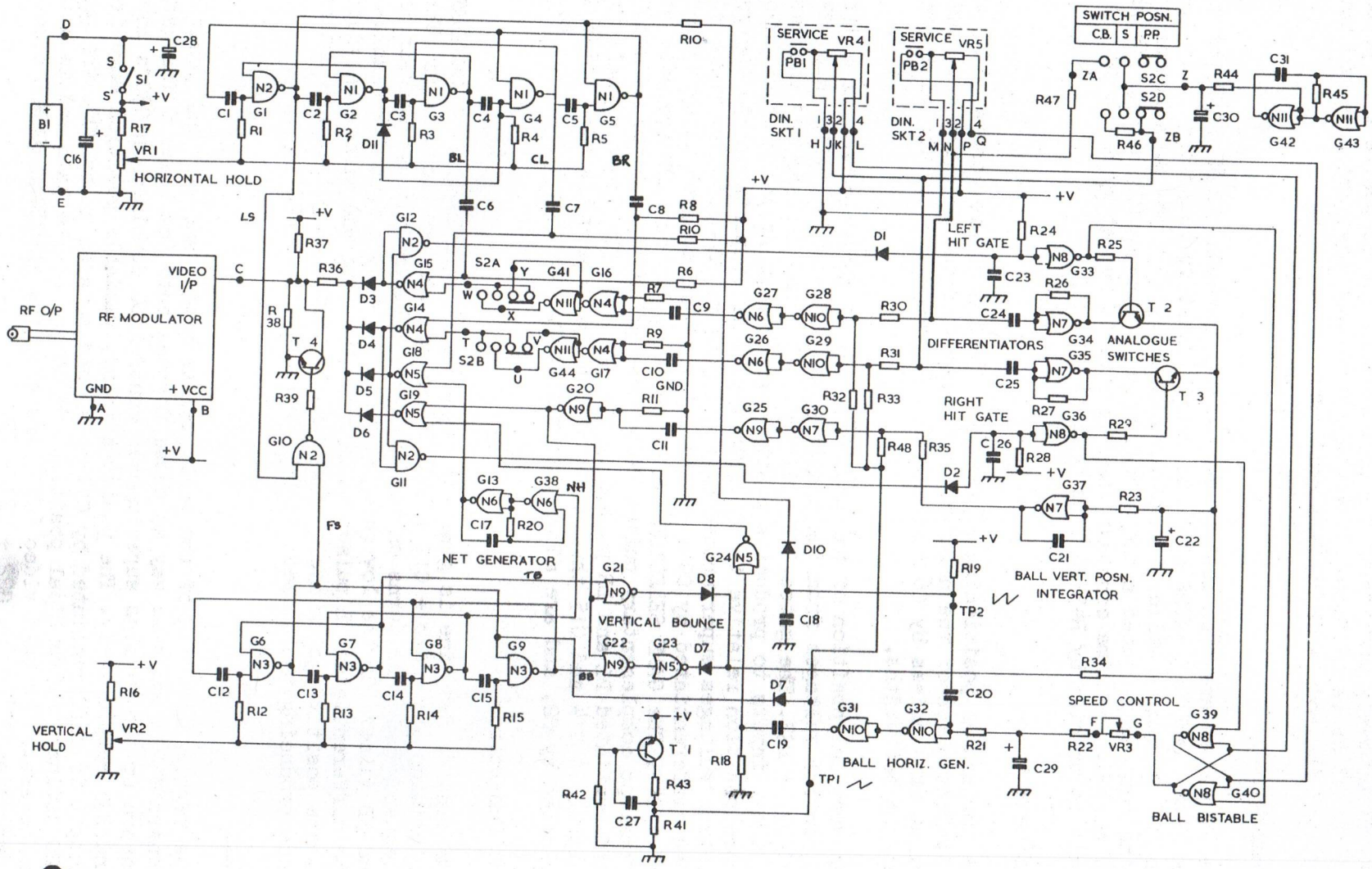
Frame Freq. Pulse Gen.

This section, which comprises G6 - G9, R12 - R15, C12 - C15 and R16 + VR2 is similar to the line frequency pulse generator. It has only 4 stages and is designed to run at 50Hz, however it operates in an identical manner. The operating frequency is controlled by the voltage on the wiper of VR2, the VERTICAL HOLD control.

TYPICAL WAVEFORMS OF THE FRAME FREQUENCY PULSE GENERATOR



VIDEOMASTER VM3 KIT Circuit Diagram



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Sync Adder

The frame sync (FS) pulses and the line sync pulses are added together by G10, effectively performing the OR function. The composite sync pulses from its output drive the base of T4 via R39 so that they are injected into the input of the modulator by T4's collector.

Frame Ramp

The FS pulses are also used to generate a sawtooth (FRAME RAMP) by driving the FRAME RAMP GENERATOR circuit. This circuit is comprised by T1, R41 - R43 and C27 forming a miller integrator driven by D7 from FS. A linear positive going ramp is produced a the output when FS charges C27 during its short low period. The time constant for the circuit is set by R42 X C27. A current limit is provide by R43 in T1's collector.

Bat Generators

The horizontal positioning of the bats (or holes) are generated by the differentiation of the negative going edges of the BL (left bat) and BR (right bat) pulses by C6 + R6 and C8 + R8 respectively. The time constants set the bat widths.

The vertical position of the bat (or hole) is generated by the addition of the DC control voltages from the player pots, VR5 and VR4, with FR by R30 + R32 and R31 + R33. The gates G27 + G28 and G26 + G29 'square up' the ramp signal at their inputs to produce a positive going edge at each output (G26 & G27) whose position relative to the frame sync, is proportional to the respective control voltages superimposed at the inputs to G28 and G29. These edges are then differentiated by C9 + R7 and C10 + R9 and squared up by G16 + G41 and G17 + G44. The GAME SELECTOR SWITCH sections S2A and S2B are able to select normal or complementary pulses from these gates to be combined with the differentiated BL and BR pulses by G14 and G15. The video signals from the outputs of G14 and G15 thus may either be bats or walls with holes in, as selected by S2, and are added into the composite video by D3 and D4.

Net Generation

The central net line is generated by a gated oscillator (NET GENERATOR), comprising G13 + G38 + C17 + R20, which operates at about 1 KHz. The frame frequency pulse NH turns on the oscillator during the gap between the TB and BB pulses. On the low going cycles, the output from G13 enables G18 and the differentiated CL pulses to be injected into the composite video by D5. On the positive going cycles the differentiated CL pulses are inhibited thus producing the dotted central line called the net.

Ball

The vertical portion of the ball (ie:its height and vertical position), is generated in the same way as those for the bats (or holes). The gates, G30 + G25 square up the FR plus superimposed control DC combined on G30's input by R48 and R35 respectively. The positive going, variable position edge from G25's output is differentiated by C11 + R11 and squared up by G20. The pulse from G20 defines the vertical position and height of the ball and is both used to generate the ball video (G19) and also the VERTICAL BOUNCE circuit comprising G21 + D8, G22 + G23 + D7.

Ball Vertical Control

The vertical speed and direction of the ball is controlled by the voltage at which C22 is charged. When it is the same as the input threshold of G37 (roughly half supply volts) the VERTICAL POSITION INTEGRATOR comprising G37 + C21 + R23 maintains a steady DC output to R35, keeping the ball still in the vertical plane of movement, at a position determined by the output voltage of G37. When the voltage on C22 is below the gate threshold, the integrator output rises, causing the ball to rise. The vertical speed is determined by the difference between the voltage on C22 and the gate threshold voltage. Similarly the ball will descend when the voltage on C22 is higher than the gate threshold.

Bounce Control

Should the ball 'hit' the TB pulse area at the top of the screen when rising, G21 will produce a positive pulse on coincidence between the TB and ball vertical pulses. Thus C22 will be positively charged via D8 + R34, the ball will then descend. Should the ball 'hit' the BB pulse area when descending, the positive coincidence pulse from G22 is inverted by G23, and C22 will be discharged through D7 + R34 on G23's output going low. Thus the ball's direction will again be reversed and made to rise.

Ball Horizontal Control

The horizontal speed and direction of the ball are controlled independently by variation of the HORIZONTAL POSITION INTEGRATOR (C29 + R22 + VR3) time constant by the setting of the SPEED CONTROL VR3 and by the state of the BALL DIRECTION BISTABLE comprising G39 and G40. The output from G40 (high or low) charges or discharges C29 via VR3 and a limiting resistor R22. This produces a slow ramp which controls the direction, position and speed of the ball via R21.

Line Ramp

A line frequency sawtooth is generated by discharging C18 via D10 + R10 with LS pulses. R19 charges C18 up during the horizontal sweep (picture) period to produce a positive going ramp. The sawtooth is combined with the horizontal position control voltage at the input to G32 by R21 and C20. The sawtooth is sliced or squared up by G32 + G31 to produce a positive going edge which defines the position of the ball. The output from G31 is differentiated by C19 + R18 and squared up by G24 to produce the ball's width.

Ball Video Generation

The horizontal and vertical components of the ball are effectively ANDed together by G19 and the resulting ball video signal injected into the composite video by D6.

Hit Circuits

Two coincidence gates G11 and G12 are each fed with bat (or wall/hole) video from G14 and G15 respectively together with the ball video. Should the ball 'hit' one of the bats (or walls), the output from the appropriate NAND gate will go low for a few short duration pulses. The two HIT GATE circuits, D1 + R24 + C23 + G33 and D2 + R28 + C26 + G37, stretch the coincidence pulses. Should the ball hit the left hand bat, the negative going pulses from G12 will rapidly discharge C23 via D1 causing the output of G33 to go high. The long time constant of R24 X C23 (about 47mS) allows C23 to slowly recharge causing the output pulse of G33 to be tens of milliseconds long. Both left and right circuits operate in the same manner.

Player Control of the Ball

The pulse from G33 on coincidence sets the BALL BISTABLE output at G40 low, causing the ball to move left to right. Also it drives the base of T2 turning it on. The voltage at the output of the bat speed differentiator comprising C24 + R26 + G34, which represents the bat's speed and direction is transfered by T2 to C22. Hence the ball's vertical direction and speed is set by that of the bat (or wall) at the moment of impact (coincidence). The same action happens on the right hand side due to the RIGHT HIT GATE circuit, right hand bat differentiator and T3.

Should a player miss the ball or if it goes through a hole, then the ball will continue off the screen as C29 becomes either fully charged or discharged, depending on the side. In order to return the ball into play, the service button on the opposite side to which the ball went off is pressed, reversing the state of the BALL BISTABLE by shorting the appropriate output to Gnd.(Chassis).

The VERY SLOW SPEED OSCILLATOR used to wobble the holes up and down is a simple astable circuit comprising G42 + G43 + C31 + R45. The period for the oscillator, about 1.5 seconds, is set by the C31 x R45 time constant. The output waveform is shaped by the R44 + C30 filter to lengthen the rise and fall times of the holes. The game selector switch sections S2C and S2D select the inputs to be 'wobbled'.

SERVICING & RETURNS

In the unlikely event that you are unable to get your VIDEOMASTER going satisfactorily, we can check it out and put it right for you for a fixed fee of £6.00 inclusive of V.A.T. and postage etc. In cases where a faulty component has inadvertantly been supplied, we shall be only too pleased to refund the fee. Should you find a faulty component yourself, we shall of course exchange it free of charge by return of post.

When returning a unit for servicing please make sure that:

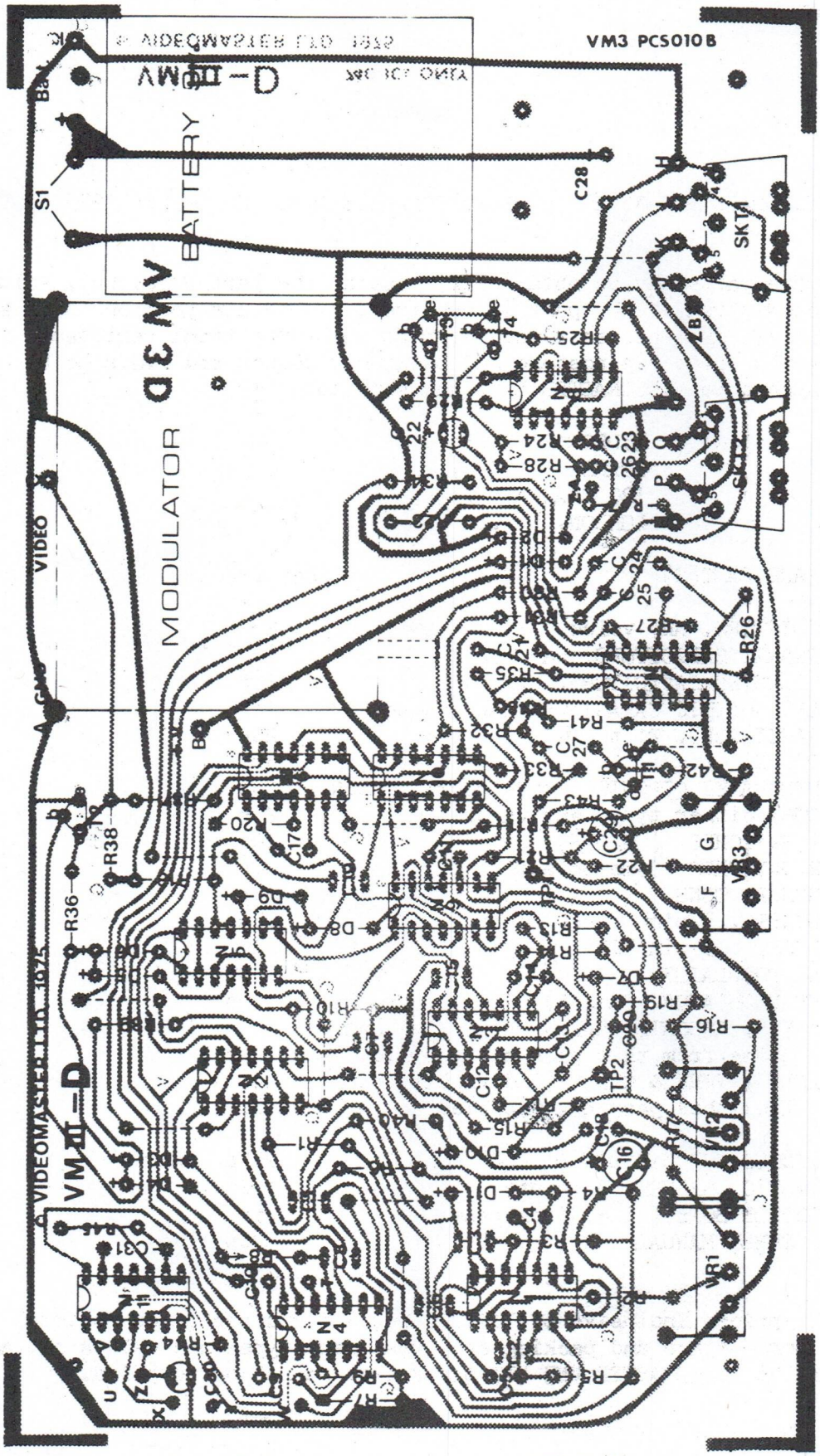
* You have included your name and address
* You state the date of purchase and the fault code(s)
* You have included the complete unit in its original packing or at least packed very well and securely
* A cheque/P.O. for £6.00 payable to VIDEOMASTER Ltd. is included in a separate envelope.

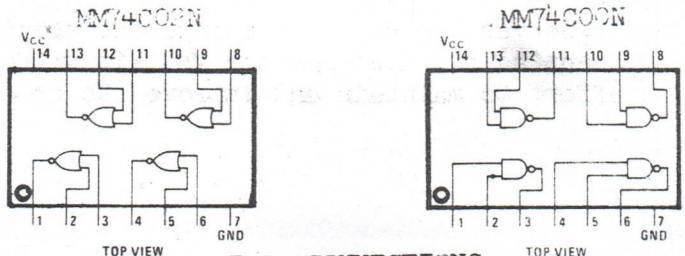
If you are returning a suspected faulty component, please make sure that:

* You have included your name and address
* You state the date of purchase and the part number and/or description of the component being returned.

Please address any return to:

VIDEOMASTER LTD,
SERVICE DEPT,
120 Chancery Lane,
London, W.C.2.





I.C. CONNECTIONS

VIDEOMASTER VM3 KIT SPARE PARTS PRICE LIST September 1975

Spare parts may be obtained by stating the part number(s), value and description of the part(s) required. Also state your own name and address and enclose a cheque or P.O. for the total remittance for the part(s) plus 30p postage and packing. Cheques and P.O.s to be made payable to VIDEOMASTER Ltd. and sent to:-

VIDEOMASTER Ltd.,
SPARES SERVICE,
120 CHANCERY LANE,
LONDON, W.C.2.

SPARE PART(S)	Each Price
RESISTORS, Any value	2p
CERAMIC CAPACITORS, any value	4p
POLYESTER CAPACITORS, 0.1uF	10p
ELECTROLYTIC CAPACITORS, any value	12p
TRANSISTORS, T1 to T4	20p
DIODES	5p
INTEGRATED CIRCUITS, MM74C00N, MM74C02N	25p
POTS, either type, any value	20p
S1 SWITCHES (ON:OFF)	20p
S2 SWITCHES (Game Selector)	40p
PUSH BUTTONS	25p
SOCKETS, 5 pin DIN PC Mounting	25p
PLUGS, 5 pin DIN	20p
UHF MODULATOR	600p
VHF MODULATOR (Band 1)	700p
PACK 7, ASSORTED HARDWARE (individual items from this pack not supplied)	100p
PACK 8, WIRE & CABLE (individual items from this pack not supplied)	120p
PRINTED CIRCUIT BOARD	250p
PLASTIC CABINET, complete	150p
CONTROL BOXES, including panel	75p
ASSEMBLY MANUAL	120p

All prices inclusive of V.A.T., but 30p must be added to total order to cover postage and packing etc. Component types and values not appearing in the VIDEOMASTER VM3 KIT parts list cannot be supplied.

VIDEOMASTER Ltd. reserves the right to change the specification and/or type of any component(s) supplied for the VM3 kit without prior notice in a continuing effort to maintain and improve its products and services.

VIDEOMASTER™

Home TV Game Kit

OPERATING INSTRUCTIONS

1. Check that the T.V. set has been switched off before plugging the unit into the aerial socket on the set. Then plug in the control boxes into the VIDEOMASTER and set the game selector switch to CATCH BALL for setting up purposes.

2. Switch on the TV set and the VIDEOMASTER unit, tune in the TV in the usual way for your set(as per it's instruction book). With a dial type tuning, the VIDEOMASTER signal should be between the channel 30 and 40 marks for UHF). With the push button type tuner, a certain amount of 'twiddling' may be necessary before the signal is found, but once set, the selected button may be permanently reserved for the VIDEOMASTER and no further tuning should be necessary in the future.

3. Sometimes you may not get a stable picture immediately. In which case adjust the units HORIZONTAL HOLD to stabilize a picture with flickering diagnol lines and the VERTICAL HOLD to stabilize a rolling bar pattern. Sometimes it may be necessary to fine tune the TV set's tuner in order to get a clear picture once the hold controls have been set. Should you not get any success then switch off the VIDEOMASTER and set it's hold controls to roughly their mid positions; then start again from (2).

   NOTE: NEVER RE-ADJUST THE TV SET'S VERTICAL OR HORIZONTAL HOLD CONTROLS FROM THEIR NORMAL POSITIONS FOR TV BROADCAST RECEPTION.

4. Some adjustment of the TV's CONTRAST and/or BRILLIANCE controls may be necessary for the best results. On colour sets the picture will be in black & white and the colour control will have no effect and should not be touched.

5. Before starting play, its a good idea to find the ball and get it on the screen. Firstly set the ball speed nearly to maximum (fully clockwise). Then set the two player control knobs fully clockwise then press the right hand player's service button, if the ball does not appear after a short while, press the left hand player's service button. Should the ball still have not appeared after a short while then switch off the unit. After a period of about 30 seconds, switch the unit back on again and repeat the procedure. Should the ball ever seem to get 'lost' in play, then follow this procedure again.

6. Once you have got the ball on the screen it should be trapped between the two 'walls'. You can now slow it down to what you think will be a suitable speed for the game you're going to play. You can also change the setting of the speed control at any point during a game to speed up the ball or slow it down. The slower you make the ball speed the longer it will take to come on the screen after a service button is pressed.

Playing the Games

PING - PONG

The object of the TV version of the game is the same as usual table top one; to return the ball to the opposition by hitting with a bat and trying to make him miss the shot.

Before starting, set the ball speed fairly high then you can turn it down later if you find it too fast. To get going one of the players should first press his service button. If the ball has not appeared after a short while, the other player should press his service button. When returning the service or the shot, if the bat is 'chopped' into the ball it will go off at a diagnal in the direction of the bat's movement. When a player misses the ball, the opposing player scores a point and then presses his button to serve the ball to himself. This feature prevents cheating - you'll soon find out why.

SOLO

This is a game for one player and is both a test of skill and endurance and also man vs. machine. The object of the game is for the solo player using the bat on the left hand side to get the ball through the moving hole in the wall on the right hand side. Every time the player misses the ball, a point is subtracted from his score and the ball must be brought back into play by pressing the right hand control box service button. Every time the ball goes through the hole a point is added to the score and the player presses his own service button. As you get more skilful, the ball speed can be increased to set an even greater challenge. If you can keep a running score greater than zero over a period you're doing well. The right hand control knob can be used to make it even more difficult by off-centering the hole in the wall.

CATCH BALL

This is a game for two players. Each controls a hole in the wall at either side of the screen. The object of the game is to try and catch the ball by moving the hole up or down to meet the ball as it comes across the screen. Should the ball hit the wall, it will be rebounded back to the opposing side. When the ball passes right through a player's hole, he scores a point. Cheating by pressing the service button gives a five point penalty to the opposition. Note that just to make things difficult not only do the holes 'wobble' up and down on their own, but one player can influence the others hole to a small extent. A one player version of this game is also possible.

There's something brilliant on T.V. tonight. You

Videomaster Limited, 119/120 Chancery Lane, London WC2A 1QU

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